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REPORT

OF THE

TESTS OF METALS

AND

OTHER MATERIALS

FOR

INDUSTRIAL PURPOSES

MADE WITH THE

UNITED STATES TESTING MACHINE AT WATERTOWN ARSENAL, MASSACHUSETTS,

DURING

THE FISCAL YEAR ENDED JUNE 30, 1897.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
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LETTER

FROM

THE SECRETARY OF WAR,

TRANSMITTING

The report of the commanding officer of Watertown Arsenal of "Tests of iron, steel, and other materials for industrial purposes," made at that arsenal during the fiscal year ending June 30, 1897.

WAR DEPARTMENT,
WASHINGTON, *December 16, 1897.*

SIR: I have the honor to transmit herewith, as required by law, report of the commanding officer of the Watertown Arsenal of "Tests of iron, steel, and other materials for industrial purposes," made at that arsenal during the fiscal year ended June 30, 1897.

Very respectfully,

R. A. ALGER, *Secretary of War.*

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

WATERTOWN ARSENAL,
Watertown, Mass., December 9, 1897.

SIR: I have the honor to forward herewith report of tests of metals, etc., made at this arsenal during the fiscal year ending June 30, 1897, in compliance with the requirements of law.

The total number of specimens tested during the year was 2,118, classified as follows:

Gun specimens	152
For Ordnance Department	330
For other Government departments	169
Investigative tests	789
Tests for private parties	678
Total	2,118

The receipts and expenditures were as follows:

Amount appropriated for testing machine and testing work	$10,000.00
Received from private parties during the year	918.75
Total received	10,918.75
Amount expended for service and labor	8,237.49
Amount expended for light, power, and tools, implements, and materials for test	2,681.26
Total expended	10,918.75

During the year the testing department has carried on, as heretofore, public tests in the examination of material for acceptance, representing the current work at this and other arsenals and places where Government work is in progress.

Investigative tests have been continued, also tests made for private parties who have availed themselves of the use of the testing machine and have defrayed the cost of such testing, as provided by law. A list of such is appended herewith.

The public tests of material for acceptance include material for field and siege guns, howitzers, and seacoast guns and mortars, the test of steel for small arms, barrels, and receivers, and for machine guns.

The material used in the 8-inch, 10-inch, and 12-inch disappearing carriages, and anchor bolts for the same have been tested.

Material from a 12-inch mortar carriage recoil cylinder that burst in service was examined.

There were tests of helical springs for 7-inch mortar carriages, balata slabs for buffers, cast and pig irons from the arsenal foundry, steel plate for the new 72-inch arsenal boilers, chain iron, cast copper, cylinders for pressure gauges, bronze breech plates and loading trays from Watertown Arsenal foundry, material all of which pertained to the Ordnance Department.

Tests of steel bars were made for the Engineer Corps, U. S. A., chain cable for the Light-House Board, a large swivel shackel for the Bureau of Equipment, Navy Department, and shot lines for the Life Saving Service.

Among the investigative tests are additional experiments on the hydrostatic test of the 8-inch tube section, supplementary to the main series of tests, which has been completed.

The scope of the investigation of this tube section has been so extended as to include all cases of simple strains and nearly all combinations of simultaneous orthogonal strains to which the tube of a gun would ordinarily be exposed.

The exact results, confirmatory as they have been to accepted formulæ, are believed to have a value fully justifying the large labor involved in carrying out this unusual series of determinations.

Heretofore in these tests the strains have been maintained within the elastic limit of the metal. Preparations are now being made to follow with overstraining forces, and investigate the effects thereof.

The elastic properties and tensile strength of steel music wire have been determined. The grade of steel employed and the process of manufacture caused this wire to represent the highest strength attained with any of the materials of construction, and they show a decided advance over earlier tests reported in this class of material. One variety of No. 14 gauge running as high as 389,470 lbs. per square inch.

Additional samples of "vibration proof" bolts and nuts were submitted by the manufacturers for test as to their ability to withstand

unlocking while subjected to vibratory influences. The tests made confirmed earlier experience, and failed to substantiate their claim to being vibration proof under the condition of jarring with hammer blows, the method of testing which was adopted.

A number of samples of granite from the State of Georgia, contributed by the Geological Survey, were received and tested. There were brick and terra cotta from the Pacific slope and from the State of Ohio.

Other tests of building material comprise the test of an important series of cement concrete cubes and columns. The columns were of different heights, and made of different proportions of cement, sand, and gravel. Hand and machine mixed.

The ultimate crushing strength of the material was ascertained, and complete observations made on the compressibility and resilience under successive increments of loads. In this class of material, by varying the proportions of the constituents it is possible to exert a controlling influence on both the ultimate strength and the rigidity, as shown by the modulus of elasticity of the columns. The columns failed by the direct crushing of the material, and from the local character of the failure it was not apparent that the ultimate strength was modified by the ratio of length to diameter of the specimens.

The compressibility as well as the crushing strength depends upon the richness of the mixture, and while the crushing strength ranged from 427 to 1,700 pounds per square inch, the compressibility of the material, as shown by the modulus of elasticity, was found between the limits of 2,273,000 and 5,000,000 pounds per square inch, the lower values belonging to the leaner mixtures.

It was shown furthermore that the modulus of elasticity for this class of material does not have a constant value under different loads, that with increased pressure there is generally a reduction in the value of the modulus.

In this respect the behavior of the concrete differs from natural stones wherein the latter usually show increased elastic rigidity as higher loads are approached.

This refers to the elastic behavior of the material in each case, the permanent sets being deducted from the total compression, or the resilience alone being considered.

The control, within limits, of the modulus of elasticity by varying the composition of the concrete is a feature of value in the refined use of this class of material.

The prominence which concrete construction is assuming makes the data developed by these tests of much practical value in architectural designs.

The strength of cordage was ascertained in another exhaustive series of tests. The experiments included manila, hemp, sisal, and cotton rope in the various commercial sizes, from a 6-thread manila line to a 10-inch rope.

In addition to the usual determinations of ultimate strength, data relating to the elastic properties were ascertained, the influence of wetting on the length of the rope when loaded and when free from stress. The effects of wetting are found to be more complex than popularly supposed, and not in all cases accompanied by a contraction in the length of the rope. Under some conditions of loading the immediate effect of wetting is a slight stretch.

The strength of manila and hemp fibres was shown to exceed 100,000 pounds per square inch.

Measurements of the several strands and individual threads of a strand, taken from a piece of rope of given length, shows from the variation in length of the elements wherein a rope must necessarily sustain loads of greatly differing intensity on the different fibers, and illustrates why a fractional part only of the aggregate strength of the fibers is realized in the finished rope.

With the complete tests of the various commercial sizes, and the examination of the elementary features of rope construction, the elastic properties and behavior of wet rope, together with the strength of knots, hitches and splices, which was also ascertained, it is believed the present series furnishes more complete data on this subject than has heretofore been brought together, and will serve as standards for reference where a knowledge of the strength and behavior of ropes is required, aiding in the comparison of present methods of manufacture with such improvements as the future may bring about in this important industry.

The crushing strength of full-sized timber posts of long and short leaf pine and spruce was made the subject of investigation. In this series 41 columns were tested.

There were new posts of material but recently received from the mills, timber in as unseasoned a state as commonly reaches the Boston market, some sticks which had been in a yard about two years, and some old and thoroughly-dried posts from a building on Federal street, Boston, Mass., which occupied a position on the site for the Southern Terminal Station.

The spruce posts were selected as representative of the range in quality commonly met in this wood.

The greatest strength was developed by the old posts. Some of these had been charred by fire, and while the strength of the charred timber was below the average of the uncharred old posts, it was about that of the less thoroughly seasoned new posts.

The relative strength of long-leaf pine posts with reference to their location in the trees, was for the butts 100, for the middle sticks 90, and for the tops 80, approximately stated.

The compressive rigidity followed in the same order as the ultimate strength of the timber.

The strength of the short-leaf pine occupied a place between the long-leaf and the spruce.

One of the old long-leaf pine posts was immersed in water for a period of one hundred and thirty days. This post upon testing failed under a load below the dry ones of its class, crushing the fibers at the extreme lower end of the post where the wood had absorbed nearly or quite the maximum amount of moisture which it could contain. This water-soaked post failed at 3,800 pounds per square inch, while the highest result shown by the dry posts was 7,000 pounds per square inch.

The occasion of installing a battery of new boilers into the arsenal plant gave the opportunity of making some observations on the behavior of riveted joints in actual construction, supplementary to the tests of joints in the testing machine; the boilers further afforded the opportunity of obtaining data upon the general behavior of different details in steam-boiler construction; all of which information assists in the application of results obtained upon material in the testing machine to the varied conditions of constructive experience.

The boilers were examined over the joints, and on corresponding gauged lengths on the solid sheet, the strains in the vicinity of the manhole, the contraction in length of the shell while under hydrostatic

pressure, the elongation of the tubes under the same conditions, and the examination of the bending strains at the roots of the flanged heads incident to the contraction of the shell and the expansion of the tubes. All of these features are included in these observations.

In the chemical laboratory analyses have been made of all material of unusual strength or other unusual physical properties, and a sufficient number of determinations to indicate the composition of the steel ordinarily used in ordnance construction.

Photographs have been taken of material under test, and the appearance of specimens after rupture shown.

In order to show the range in the amount of hygroscopic water absorbed by or lost by ropes exposed to atmospheric conditions, weighings have been made of samples from time to time extending over a period of several months.

Other work accomplished in the testing department in addition to the direct work of testing has been the designing of an apparatus for the endurance tests of shafts—a six-specimen machine—in which the stresses may be made to alternate from tensile to compressive stresses of equal magnitude, or where either tensile or compressive stresses, one or the other, may be the greater, the opposite stress being diminished to zero or even alternating between a maximum and minimum value of the same kind of stress.

These combinations are made possible by applying simultaneous bending and endwise stresses to the rotating shafts.

With the introduction of various grades of steel possessing high physical properties in the testing machine, the importance of ascertaining the endurance of the metal under conditions analogous to those of service becomes more and more apparent. The endurance of metal under repeated stresses might reasonably be supposed to indicate the most desirable manner of attaining these high physical properties, whether by chemical composition, mechanical means, or by heat treatment.

An impact machine has been designed and contracted for. This is of the vertical type, and will admit of attaining velocities of about 20 feet per second. The parts of the apparatus have been designed very massive for the purpose of obtaining great rigidity under the shocks of testing.

So vague is the information at present available on the subject of impact that elementary tests are necessary to establish a working basis of operations.

One of the ends constantly kept in view in the design of the vertical impact machine was to provide suitable machinery for acquiring fundamental data; hence in the present machine it is expected to ascertain and define the resistance in detail encountered in the deformation of material by suddenly applied loads.

It is proposed to introduce microscopic metallography in the investigation of constructive materials, and the appliances necessary to this end have been obtained. The intimate relations existing among tests by impact, the effect of heat treatment, tempering and annealing of steel, the effect of repeated stresses and internal strains are such that much aid is expected from the microscopic inquiry.

It is further expected that the facilities afforded by the standard comparator, which instrument is now being made in the testing department, will be of importance in certain investigative directions, and microscopic research be accessory to investigating work of importance heretofore impracticable to undertake.

The apparatus already provided for and that which has been designed should be considered collectively as well as in detail, as each part will reenforce the others and aid in filling breaks in the continuity of present information.

The room set apart on the second floor at the north end of the testing laboratory for a museum of interesting specimens has been provided with cases for the reception of material, and already contain specimens which have been reserved for exhibit. In time past a large amount of valuable instructive material has been lost for want of a place where it might be carefully preserved. There is, however, an almost constant tendency to accumulate interesting material in the testing department, and the present facilities for the collection of specimens will be immediately improved.

Including the present report there has now emanated from the testing department seventeen annual reports, "Tests of metals, etc."

These reports cover a wide range of material, and from the nature of the case information on a given subject is often disseminated among several reports covering more or less remote periods of time.

It is believed that a compilation of the data embodied in these several reports might with great advantage be brought together in a concise form and published in a special volume, classifying and arranging the data according to subjects.

Such a volume should present the general results thus far developed, following substantially the same method as adopted in the several annual reports—that is, presenting the facts of the tests, omitting the expression of opinions and comments upon the results.

An incidental advantage to be derived in the compilation of such a volume would consist in disclosing at the time of compilation certain features which should be made the subject of inquiry in order to give greater completeness to the several subjects treated upon.

Mr. J. E. Howard, engineer of tests, has conducted during the year the operations of the testing department with his usual zeal, intelligence, and faithfulness.

Very respectfully, your obedient servant,

J. W. REILLY,
Major, Ordnance Department, U. S. A., Commanding.

The CHIEF OF ORDNANCE, U. S. A.,
Washington, D. C.

REPORT

OF THE

TESTS OF METALS AND OTHER MATERIALS

FOR

INDUSTRIAL PURPOSES,

MADE WITH THE

UNITED STATES TESTING MACHINE AT WATERTOWN ARSENAL, MASSACHUSETTS,

DURING THE

FISCAL YEAR ENDED JUNE 30, 1897.

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3.2-INCH B. L. STEEL FIELD GUNS.

SPECIMENS FROM TUBES AND JACKETS.

TUBE No. 155.

No. 5629.

Marks, $\frac{32\ R\ 155\ T}{B\ T_4\ M}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000300	.000200	.....	.....	
4,000	20,000	.000700	.000400	.....	.....	
6,000	30,000	.001050	.000350	.....	.....	
7,000	35,000	.001250	.000200	0.	.....	
8,000	40,000	.001400	.000150	.....	.....	
8,400	42,000	.001500	.000100	0.	.....	
8,800	44,000	.001550	.000050	.....	.....	
9,200	46,000	.001600	.000050	.....	.....	
9,600	48,000	.001700	.000100	.....	.....	
10,000	50,000	.001750	.000050	.....	.....	
10,200	51,000	.001800	.000050	.....	.....	
10,400	52,000	.001850	.000050	.....	.....	
10,600	53,000	.001900	.000050	.....	.....	
10,800	54,000	.001950	.000050	.....	.....	Elastic limit.
11,000	55,000	.002400	.000450	.....	.....	
11,200	56,000	.004250	.001850	.....	.....	
11,400	57,000	.006400	.002150	.....	.....	
11,600	58,000	.007050	.000650	.....	.....	
11,800	59,000	.007950	.000900	.....	.....	
19,620	98,100	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	98,100
Elastic limit per square inch of original section	do...	54,000
Elongation per inch after rupture	inch..	.2350
Elongation per inch under strain at elastic limit	do...	.001950
Reduction in diameter at point of rupture	do...	.115
Reduction in area after rupture, per cent of original section		40.3
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		".22*, ".25*

TUBE No. 170.

No. 5630.

Marks, $\frac{32\ R\ 170\ T}{B\ T,\ M}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000150	.000150	0.	.....	
2,000	10,000	.000400	.000250	.....	.....	
4,000	20,000	.000750	.000350	.....	.....	
6,000	30,000	.001050	.000300	.....	.....	
7,000	35,000	.001300	.000250	.000050	.000050	
8,000	40,000	.001450	.000150	.....	.....	
8,400	42,000	.001500	.000050	.000100	.000050	
8,800	44,000	.001550	.000050	.....	.....	
9,200	46,000	.001650	.000100	.....	.....	
9,400	47,000	.001700	.000050	.....	.....	
9,600	48,000	.001750	.000050	.....	.....	
9,800	49,000	.001800	.000050	.....	.....	
10,000	50,000	.001850	.000050	.....	.....	
10,200	51,000	.001950	.000100	.....	.....	
10,400	52,000	.002000	.000050	.....	.....	
10,600	53,000	.002100	.000100	.....	.....	Elastic limit.
10,800	54,000	.002350	.000250	.....	.....	
11,000	55,000	.003400	.001050	.....	.....	
11,200	56,000	.004300	.000900	.....	.....	
11,400	57,000	.005400	.001100	.....	.....	
11,600	58,000	.006800	.001400	.....	.....	
19,410	97,050	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	97,050
Elastic limit per square inch of original section	do...	53,000
Elongation per inch after rupture	inch..	.2150
Elongation per inch under strain at elastic limit	do...	.002100
Reduction in diameter at point of rupture	do...	.115
Reduction in area after rupture, per cent of original section		40.3
Position of rupture		".65 from neck
Character of broken surface		silky; trace of granulation
Elongation of inch sections		", ", "

TUBE No. 172.

No. 5631.

Marks, $\frac{32\ R\ 172\ T}{B\ T,\ M}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000150	.000150	.....	.....	
2,000	10,000	.000400	.000250	.....	.....	
4,000	20,000	.000700	.000300	.....	.....	
6,000	30,000	.001050	.000350	.....	.....	
7,000	35,000	.001350	.000300	.000100	.000100	
8,000	40,000	.001500	.000150	.....	.....	
8,400	42,000	.001600	.000100	.000150	.000050	
8,600	43,000	.001700	.000100	.....	.....	Elastic limit.
8,800	44,000	.009000	.007300	.....	.....	
9,000	45,000	.009600	.000600	.....	.....	
9,200	46,000	.010150	.000550	.....	.....	
9,400	47,000	.010800	.000650	.....	.....	
9,600	48,000	.011400	.000600	.....	.....	
18,420	92,100	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	92,100
Elastic limit per square inch of original section	do...	43,000
Elongation per inch after rupture	inch..	.2150
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.095
Reduction in area after rupture, per cent of original section		34.0
Position of rupture		1″.1 from neck
Character of broken surface		silky, 80 per cent; granular, 20 per cent
Elongation of inch sections		″.27*, ″.16

TUBE NO. 173.

No. 5632.

Marks, $\frac{32\ R\ 173\ T}{B\ T, M}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000150	.000150	0.	.....	
2,000	10,000	.000350	.000200	.....	.....	
4,000	20,000	.000650	.000300	.....	.....	
6,000	30,000	.001000	.000350	.....	.....	
7,000	35,000	.001200	.000200	0.	.....	
8,000	40,000	.001400	.000200	.....	.....	
8,400	42,000	.001500	.000100	0.	.....	
8,800	44,000	.001550	.000050	.....	.....	
9,200	46,000	.001600	.000050	.....	.....	
9,600	48,000	.001700	.000100	.....	.....	
10,000	50,000	.001750	.000050	.....	.....	Elastic limit.
		.015000	.013250	.....	.....	
10,200	51,000	.0200	.0050	.....	.....	
16,180	80,900	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	80,900
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.2600
Elongation per inch under strain at elastic limit	do...	.001750
Reduction in diameter at point of rupture	do...	.115
Reduction in area after rupture, per cent of original section		40.3
Position of rupture		1".1 from neck
Character of broken surface		silky
Elongation of inch sections		".18, ".34*

TUBE No. 176.

No. 5666.

Marks, $\frac{32\ R\ 176\ T}{B\ T,\ M}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000150	.000150	0.	.....	
2,000	10,000	.000350	.000200	.....	.....	
4,000	20,000	.000650	.000300	.....	.....	
6,000	30,000	.001000	.000350	.....	.....	
7,000	35,000	.001200	.000200	0.	.....	
8,000	40,000	.001350	.000150	.....	.....	
8,400	42,000	.001400	.000050	0.	.....	
8,600	43,000	.001450	.000050	.....	.....	
8,800	44,000	.001500	.000050	.....	.....	
9,000	45,000	.001500	0.	.....	.....	
9,200	46,000	.001550	.000050	.....	.....	
9,400	47,000	.001600	.000050	.....	.....	
9,600	48,000	.001650	.000050	.....	.....	
9,800	49,000	.001650	0.	.....	.....	
10,000	50,000	.001700	.000050	.....	.....	
10,200	51,000	.001750	.000050	.....	.....	
10,400	52,000	.001750	0.	.....	.....	
10,600	53,000	.001800	.000050	.....	.....	
10,800	54,000	.001850	.000050	.....	.....	Elastic limit.
11,000	55,000	.002000	.000150	.....	.....	
11,200	56,000	.004250	.002250	.....	.....	
11,400	57,000	.006500	.002250	.....	.....	
11,600	58,000	.009500	.003000	.....	.....	
11,800	59,000	.010000	.000500	.....	.....	
17,970	89,850	.1400	.1300	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89,850
Elastic limit per square inch of original section	do...	54,000
Elongation per inch after rupture	inch..	.2200
Elongation per inch under strain at elastic limit	do...	.001850
Reduction in diameter at point of rupture	do...	.135
Reduction in area after rupture, per cent of original section		46.2
Position of rupture		″.6 from neck
Character of broken surface		silky
Elongation of inch sections		″.34*, ″.10

TUBE No. 180.

No. 5667.

Marks, $\frac{32\ R\ 180\ T}{B\ T,\ M}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000350	.000250	.....	.....	
4,000	20,000	.000650	.000300	.....	.....	
6,000	30,000	.001000	.000350	.....	.....	
7,000	35,000	.001150	.000150	0.	.....	
8,000	40,000	.001300	.000150	.....	.....	
8,400	42,000	.001400	.000100	0.	.....	
8,600	43,000	.001400	0.	.....	.....	
8,800	44,000	.001450	.000050	.....	.....	
9,000	45,000	.001500	.000050	.....	.....	
9,200	46,000	.001550	.000050	.....	.....	
9,400	47,000	.001550	0.	.....	.....	
9,600	48,000	.001600	.000050	.....	.....	
9,800	49,000	.001600	0.	.....	.....	
10,000	50,000	.001650	.000050	.....	.....	
10,200	51,000	.001700	.000050	.....	.....	
10,400	52,000	.001750	.000050	.....	.....	Elastic limit.
10,600	53,000	.001850	.000100	.....	.....	
		.004500	.002650	.....	.....	
10,800	54,000	.006000	.001500	.....	.....	
11,000	55,000	.006750	.000750	.....	.....	
11,200	56,000	.007750	.001000	.....	.....	
11,400	57,000	.008750	.001000	.....	.....	
18,660	93,300	.1400	.131250	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	93,300
Elastic limit per square inch of original section	do...	52,000
Elongation per inch after rupture	inch..	.2350
Elongation per inch under strain at elastic limit	do...	.001750
Reduction in diameter at point of rupture	do...	.125
Reduction in area after rupture, per cent of original section		43.3
Position of rupture		at middle of stem
Character of broken surface		silky, trace of granulation
Elongation of inch sections		″.25*, ″.22*

JACKET No. 169.

No. 5633.

Marks, $\frac{32\ B\ 169\ J}{B\ T_2\ I}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000150	.000150	0.	.....	
2,000	10,000	.000350	.000200	.....	.....	
4,000	20,000	.000650	.000300	.....	.....	
6,000	30,000	.001000	.000350	.....	.....	
8,000	40,000	.001250	.000250	0.	.....	
9,200	46,000	.001500	.000250	0.	.....	
9,600	48,000	.001550	.000050	.....	.....	
9,800	49,000	.001600	.000050	.....	.....	
10,000	50,000	.001700	.000100	.....	.....	
10,200	51,000	.001750	.000050	.....	.....	
10,400	52,000	.001800	.000050	.....	.....	
10,600	53,000	.001900	.000100	.....	.....	Elastic limit.
10,800	54,000	.002050	.000150	.....	.....	
11,000	55,000	.002600	.000550	.....	.....	
11,200	56,000	.004450	.001850	.....	.....	
11,400	57,000	.005400	.000950	.....	.....	
11,600	58,000	.006500	.001100	.....	.....	
19,430	97,150	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	97,150
Elastic limit per square inch of original section	do...	53,000
Elongation per inch after rupture	inch..	.2200
Elongation per inch under strain at elastic limit	do...	.001900
Reduction in diameter at point of rupture	do...	.125
Reduction in area after rupture, per cent of original section		43.3
Position of rupture		".95 from neck
Character of broken surface		silky
Elongation of inch sections		".32*, ".12

JACKET No. 171.

No. 5634.

Marks, $\frac{32\ R\ 171\ J}{M\ T, I}$
Diameter, $''.505$.
Sectional area, .20 square inch.
Gauged length, $2''$.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000150	.000150	0.	.....	
2,000	10,000	.000400	.000250	.....	.....	
4,000	20,000	.000750	.000350	.....	.....	
6,000	30,000	.001050	.000300	.....	.....	
8,000	40,000	.001400	.000350	.000050	.000050	
9,200	46,000	.001650	.000250	.000050	0.	
9,400	47,000	.001700	.000050	.....	.....	
9,600	48,000	.001750	.000050	.....	.....	
9,800	49,000	.001800	.000050	.....	.....	
10,000	50,000	.001850	.000050	.....	.....	
10,200	51,000	.001900	.000050	.....	.....	
10,400	52,000	.002000	.000100	.....	.....	
10,600	53,000	.002050	.000050	.....	.....	Elastic limit.
10,800	54,000	.002350	.000300	.....	.....	
11,000	55,000	.003150	.000800	.....	.....	
11,200	56,000	.004250	.001100	.....	.....	
11,400	57,000	.005150	.000900	.....	.....	
11,600	58,000	.006400	.001250	.....	.....	
19,990	99,950	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	99,950
Elastic limit per square inch of original section	do...	53,000
Elongation per inch after rupture	inch..	.2250
Elongation per inch under strain at elastic limit	do...	.002050
Reduction in diameter at point of rupture	do...	.115
Reduction in area after rupture, per cent of original section		40.3
Position of rupture		$1''.07$ from neck
Character of broken surface		silky, trace of granulation
Elongation of inch sections		$''.27^*, ''.18$

JACKET No. 172.

No. 5648.

Marks, $\frac{32\ R\ 172\ J}{M\ T_2\ I}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	
1,000	5,000	.000100	.000100	0.	.....	Initial load.
2,000	10,000	.000300	.000200	.....	.....	
4,000	20,000	.000550	.000250	.....	.....	
6,000	30,000	.000950	.000400	.....	.....	
8,000	40,000	.001300	.000350	0.	.....	
9,200	46,000	.001550	.000250	0.	.....	
9,400	47,000	.001600	.000050	.....	.....	
9,600	48,000	.001600	0.	.....	.....	
9,800	49,000	.001650	.000050	.....	.....	
10,000	50,000	.001700	.000050	.....	.....	
10,200	51,000	.001800	.000100	.....	.....	Elastic limit.
10,400	52,000	.002750	.000950	.....	.....	
10,600	53,000	.006000	.003250	.....	.....	
10,800	54,000	.007000	.001000	.....	.....	
11,000	55,000	.007600	.000600	.....	.....	
11,200	56,000	.008300	.000700	.....	.....	
18,410	92,050	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	92,050
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.2450
Elongation per inch under strain at elastic limit	do....	.001800
Reduction in diameter at point of rupture	do...	″.125
Reduction in area after rupture, per cent of original section		43.3
Position of rupture		1″.2 from neck
Character of broken surface		silky
Elongation of inch sections		″.20, ″.29*

JACKET No. 173.

No. 5649.

Marks, $\frac{32\ R\ 173\ J}{M\ T_2\ I}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000300	.000200	.....	.....	
4,000	20,000	.000650	.000350.	.....	.....	
6,000	30,000	.001000	.000350	.....	.....	
8,000	40,000	.001350	.000350	0.	.....	
9,200	46,000	.001600	.000250	0.	.....	
9,400	47,000	.001700	.000100	.....	.....	Elastic limit.
9,600	48,000	.002650	.000950	.....	.....	
9,800	49,000	.003400	.000750	.....	.....	
10,000	50,000	.005500	.002100	.....	.....	
10,200	51,000	.007500	.002000	.....	.....	
10,400	52,000	.008750	.001250	.....	.....	
17,590	87,950	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	87,950
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.2450
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.145
Reduction in area after rupture, per cent of original section		49.1
Position of rupture		″.90 from neck
Character of broken surface		silky
Elongation of inch sections		″.13, ″.36*

JACKET No. 179.

No. 5668.

Marks, $\frac{32\ R\ 179\ J}{M\ T_2\ I}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000150	.000150	0.	.....	
2,000	10,000	.000350	.000200	.....	.....	
4,000	20,000	.000700	.000350	.....	.....	
6,000	30,000	.001000	.000300	.....	.....	
8,000	40,000	.001300	.000300	0.	.....	
9,200	46,000	.001500	.000200	0.	.....	
9,400	47,000	.001550	.000050	.....	.....	
9,600	48,000	.001600	.000050	.....	.....	
9,800	49,000	.001650	.000050	.....	.....	
10,000	50,000	.001700	.000050	.....	.....	
10,200	51,000	.001750	.000050	.....	.....	
10,400	52,000	.001750	0.	.....	.....	
10,600	53,000	.001850	.000100	.....	.....	Elastic limit.
10,800	54,000	.002100	.000250	.....	.....	
11,000	55,000	.002400	.000300	.....	.....	
11,200	56,000	.003250	.000850	.....	.....	
11,400	57,000	.004250	.001000	.....	.....	
11,600	58,000	.005350	.001100	.....	.....	
19,600	98,000	.1300	.124650	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	98,000
Elastic limit per square inch of original section	do...	53,000
Elongation per inch after rupture	inch..	.2300
Elongation per inch under strain at elastic limit	do...	.001850
Reduction in diameter at point of rupture	do...	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		".7 from neck
Character of broken surface		granular 60 per cent, silky 40 per cent
Elongation of inch sections		".33* ".18

JACKET No. 180.

No. 5669.

Marks, $\frac{32\ R\ 180\ J}{M\ T_2\ I}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000150	.000150	0.	.....	
2,000	10,000	.000350	.000200	.....	.....	
4,000	20,000	.000700	.000350	.....	.....	
6,000	30,000	.001000	.000300	.....	.....	
8,000	40,000	.001300	.000300	0.	.....	
9,200	46,000	.001600	.000300	0.	.....	
9,400	47,000	.001650	.000050	.....	.....	
9,600	48,000	.001650	0.	.....	.....	
9,800	49,000	.001750	.000100	.....	.....	
10,000	50,000	.001800	.000050	.....	.....	Elastic limit.
10,200	51,000	.001900	.000100	.....	.....	
		.002050	.000150	.....	.....	
10,400	52,000	.002500	.000450	.....	.....	
10,600	53,000	.004250	.001750	.....	.....	
10,800	54,000	.005000	.000750	.....	.....	
11,000	55,000	.006150	.001150	.....	.....	
11,200	56,000	.007000	.000850	.....	.....	
18,960	94,800	.1450	.1380	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	94,800
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.2300
Elongation per inch under strain at elastic limit	do...	.001800
Reduction in diameter at point of rupture	do...	.135
Reduction in area after rupture, per cent of original section		46.2
Position of rupture		".95 from neck
Character of broken surface		silky
Elongation of inch sections		".13, ".33*

TABULATION OF TENSION SPECIMENS FROM 3.2-INCH B. L. STEEL FIELD GUNS (STEMS 2" LONG, ".505 DIAMETER).

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.	Remarks.
			Pounds.	*Pounds.*	*Pr. ct.*	*Pr. ct.*		
5629	Tube No. 155..	Middle .	54,000	98,100	23.5	40.3	Silky	Breech end.
5630	Tube No. 170..	...do	53,000	97,050	21.5	40.3	Silky, trace of granulation.	Do.
5631	Tube No. 172..	...do	43,000	92,100	21.5	34.0	Silky 80 per cent, granular 20 per cent.	Do.
5632	Tube No. 173..	...do	50,000	80,900	26.0	40.3	Silky	Do.
5666	Tube No. 176..	...do	54,000	89,850	22.0	46.2	.....do	Do.
5667	Tube No. 180..	...do	52,000	93,300	23.5	43.3	Silky, trace of granulation.	Do.
5633	Jacket No. 169	Inside ..	53,000	97,150	22.0	43.2	Silky	Do.
5634	Jacket No. 171	...do	53,000	99,950	22.5	40.3	Silky, trace of granulation.	Muzzle end.
5648	Jacket No. 172	...do	51,000	92,050	24.5	43.3	Silky	Do.
5649	Jacket No. 173	...do	47,000	87,950	24.5	49.1	.....do	Do.
5668	Jacket No. 179	...do	53,000	98,000	23.0	37.1	Granular 60 per cent, silky 40 per cent.	Do.
5669	Jacket No. 180	...do	50,000	94,800	23.0	46.2	Silky	Do.

5-INCH B. L. STEEL SIEGE RIFLES.

SPECIMENS FROM TUBE AND JACKET.

TUBE.

No. 5703.

Marks, $\frac{8799\ B_1}{M\ T_2\ M}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000250	.000150	.....	.....	
4,000	20,000	.000550	.000300	.....	.....	
6,000	30,000	.000950	.000400	.....	.....	
7,000	35,000	.001100	.000150	0.	.....	
8,000	40,000	.001350	.000250	.....	.....	
8,400	42,000	.001450	.000100	0.	.....	
8,600	43,000	.001500	.000050	.....	.....	
8,800	44,000	.001550	.000050	.....	.....	
9,000	45,000	.001600	.000050	.....	.....	Elastic limit.
9,200	46,000	.007500	.005900	.....	.....	
9,400	47,000	.008200	.000700	.....	.....	
9,600	48,000	.009300	.001100	.....	.....	
9,800	49,000	.010500	.001200	.....	.....	
10,000	50,000	.011500	.001000	.....	.....	
15,940	79,700	.1750	.1635	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	79,700
Elastic limit per square inch of original section	do...	45,000
Elongation per inch after rupture	inch..	.2800
Elongation per inch under strain at elastic limit	do...	.001600
Reduction in diameter at point of rupture	do...	.145
Reduction in area after rupture, per cent of original section		49.1
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		".29*, ".27*

JACKET.

No. 5687.

Marks, $\frac{8042\ B_3}{M\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
10,000	40,000	.001333	.000366	0.	.....	
11,500	46,000	.001533	.000200	0.	.....	
11,750	47,000	.001600	.000067	.....	.....	Elastic limit.
12,000	48,000	.001733	.000133	.....	.....	
12,250	49,000	.004500	.002767	.....	.....	
12,500	50,000	.008000	.003500	.....	.....	
12,750	51,000	.008600	.000600	.....	.....	
13,000	52,000	.009400	.000800	.....	.....	
21,920	87,680	.1400	.1306	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	87,680
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.2100
Elongation per inch under strain at elastic limit	do...	.001600
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.3 from neck
Character of broken surface		silky
Elongation of inch sections		″.13, ″.32*, ″.18

7-INCH B. L. SIEGE HOWITZER.

SPECIMENS FROM TUBES AND JACKET.

TUBE.

No. 5707.

Marks, $\frac{8969\ B_1}{B\ T, M}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000250	.000150	.....	.....	
4,000	20,000	.000600	.000350	.....	.....	
6,000	30,000	.000950	.000350	.....	.....	
7,000	35,000	.001100	.000150	0.	.....	
8,000	40,000	.001350	.000250	.....	.....	
8,400	42,000	.001450	.000100	0.	.....	
8,600	43,000	.001500	.000050	.....	.....	
8,800	44,000	.001550	.000050	.....	.....	
9,000	45,000	.001550	0.	.....	.....	
9,200	46,000	.001600	.000050	.....	.....	
9,400	47,000	.001600	0.	.....	.....	
9,600	48,000	.001650	.000050	.....	.....	
9,800	49,000	.001700	.000050	.....	.....	Elastic limit.
10,000	50,000	.001850	.000150	.....	.....	
10,200	51,000	.008500	.006650	.....	.....	
10,400	52,000	.009500	.001000	.....	.....	
10,600	53,000	.010050	.000550	.....	.....	
10,800	54,000	.010750	.000700	.....	.....	
17,430	87,150	.1650	.154250	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	87,150
Elastic limit per square inch of original section	do...	49.0 0
Elongation per inch after rupture	inch..	.2800
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.145
Reduction in area after rupture, per cent of original section		49.1
Position of rupture		″.98 from neck
Character of broken surface		silky
Elongation of inch sections		″.37*, ″.19

TUBE.

No. 5717.

Marks, $\frac{8909\ B_5}{M\ T_2\ M}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000150	.000150	0.	.....	
2,000	10,000	.000350	.000200	.....	.....	
4,000	20,000	.000800	.000450	.....	.....	
6,000	30,000	.001150	.000350	.....	.....	
7,000	35,000	.001300	.000150	0.	.....	
8,000	40,000	.001450	.000150	.....	.....	
8,400	42,000	.001550	.000100	.000050	.000050	
8,600	43,000	.001600	.000050	.....	.....	
8,800	44,000	.001700	.000100	.....	.....	
9,000	45,000	.001750	.000050	.....	.....	
9,200	46,000	.001800	.000050	.....	.....	
9,400	47,000	.001850	.000050	.....	.....	
9,600	48,000	.001900	.000050	.....	.....	
9,800	49,000	.001950	.000050	.....	.....	Elastic limit.
10,000	50,000	.005500	.003550	.....	.....	
10,200	51,000	.007750	.002250	.....	.....	
10,400	52,000	.008500	.000750	.....	.....	
10,600	53,000	.009600	.001100	.....	.....	
10,800	54,000	.010550	.000950	.....	.....	
17,700	88,500	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	88,500
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.2150
Elongation per inch under strain at elastic limit	do...	.001950
Reduction in diameter at point of rupture	do...	.085
Reduction in area after rupture, per cent of original section		30.7
Position of rupture		1″ from neck
Character of broken surface		granular, flaky spot of metal at the circumference
Elongation of inch sections		″.25*, ″.18

JACKET.

No. 5702.

Marks, $\frac{7961\ B_3\ F_4\ A}{B\ T,\ M}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
10,000	40,000	.001367	.000367	0.	.....	
11,500	46,000	.001600	.000233	.000033	.000033	
11,750	47,000	.001667	.000067	.....	.....	
12,000	48,000	.001667	0.	.....	.....	
12,250	49,000	.001700	.000033	.....	.....	
12,500	50,000	.001733	.000033	.....	.....	
12,750	51,000	.001800	.000067	.....	.....	
13,000	52,000	.001833	.000033	.....	.....	Elastic limit.
13,250	53,000	.001967	.000134	.....	.....	
13,500	54,000	.005333	.003366	.....	.....	
13,750	55,000	.007833	.002500	.....	.....	
14,000	56,000	.008533	.000700	.....	.....	
14,250	57,000	.009333	.000800	.....	.....	
23,730	94,920	.1400	.130667	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	94,920
Elastic limit per square inch of original section	do...	52,000
Elongation per inch after rupture	inch..	.2267
Elongation per inch under strain at elastic limit	do...	.001833
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.3 from neck
Character of broken surface		silky
Elongation of inch sections		″.15, ″.32ª, ″.21

7-INCH B. L. SIEGE MORTARS.

SPECIMENS FROM BODIES.

BODY No. 5.

No. 5647.

Marks, $\frac{7\,M\,R_5\,G\,B}{B\,T_2\,I}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001067	.000367	.....	.....	
8,750	35,000	.001233	.000166	0.	.....	
10,000	40,000	.001433	.000200	.....	.....	
10,500	42,000	.001500	.000067	0.	.....	
10,750	43,000	.001533	.000033	.....	.....	
11,000	44,000	.001567	.000034	.....	.....	
11,250	45,000	.001600	.000033	.....	.....	
11,500	46,000	.001633	.000033	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	
12,000	48,000	.001700	.000033	.....	.....	
12,250	49,000	.001767	.000067	.....	.....	
12,500	50,000	.001833	.000066	.....	.....	
12,750	51,000	.001867	.000034	.....	.....	Elastic limit.
13,000	52,000	.002033	.000166	.....	.....	
13,250	53,000	.002600	.000567	.....	.....	
13,500	54,000	.003667	.001067	.....	.....	
13,750	55,000	.005000	.001333	.....	.....	
14,000	56,000	.006167	.001167	.....	.....	
24,060	96,240	.1533	.147133	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	96,240
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.1567
Elongation per inch under strain at elastic limit	do...	.001867
Reduction in diameter at point of rupture	do...	.064
Reduction in area after rupture, per cent of original section		21.4
Position of rupture		1″.4 from neck
Character of broken surface		granular, radiating from a flaky spot at the circumferance
Elongation of inch sections		″.12 ″.2[*], ″.14

Body No. 6.

No. 5693.

Marks, $\frac{7\ M\ R_2\ G\ B}{B\ T_2\ I}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001100	.000133	0.	.....	
10,000	40,000	.001300	.000200	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001500	.000067	.....	.....	
11,500	46,000	.001533	.000033	.....	.....	
11,750	47,000	.001567	.000034	.....	.....	
12,000	48,000	.001600	.000033	.....	.....	
12,250	49,000	.001633	.000033	.....	.....	
12,500	50,000	.001700	.000067	.....	.....	
12,750	51,000	.001733	.000033	.....	.....	Elastic limit.
13,000	52,000	.001900	.000167	.....	.....	
13,250	53,000	.002367	.000467	.....	.....	
13,500	54,000	.004333	.001966	.....	.....	
13,750	55,000	.005667	.001334	.....	.....	
14,000	56,000	.007333	.001666	.....	.....	
22,460	89,840	.1300	.122667	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89,840
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.2100
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section	do...	44.6
Position of rupture		1″.4 from neck
Character of broken surface		silky
Elongation of inch sections		″.18, ″.33+, ″.12

Body No. 7.

No. 5694.

Marks, $\frac{7\,M\,R_1\,G\,B}{M\,T_1\,O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001033	.000366	.....	.....	
8,750	35,000	.001200	.000167	0.	.....	
10,000	40,000	.001400	.000200	.....	.....	
10,500	42,000	.001433	.000033	0.	.....	
10,750	43,000	.001467	.000034	.....	.....	
11,000	44,000	.001500	.000033	.....	.....	
11,250	45,000	.001533	.000033	.....	.....	
11,500	46,000	.001567	.000034	.....	.....	
11,750	47,000	.001600	.000033	.....	.....	
12,000	48,000	.001633	.000033	.....	.....	
12,250	49,000	.001667	.000034	.....	.....	
12,500	50,000	.001700	.000033	.....	.....	
12,750	51,000	.001733	.000033	.....	.....	
13,000	52,000	.001800	.000067	.....	.....	Elastic limit.
13,250	53,000	.002000	.000200	.....	.....	
13,500	54,000	.005333	.003333	.....	.....	
13,750	55,000	.006333	.001000	.....	.....	
14,000	56,000	.007333	.001000	.....	.....	
14,250	57,000	.008167	.000834	.....	.....	
23,110	92,440	.1633	.155133	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	92,440
Elastic limit per square inch of original section	do...	52,000
Elongation per inch after rupture	inch..	.2233
Elongation per inch under strain at elastic limit	do...	.001800
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1″.3 from neck
Character of broken surface		silky
Elongation of inch sections		″.26*, ″.28*, ″.13

Body No. 9.

No. 5692.

Marks, $\frac{7\,M\,R_2\,G\,B}{M\,T,\,O}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001033	.000366	.....	.....	
8,750	35,000	.001233	.000200	0.	.....	
10,000	40,000	.001400	.000167	.....	.....	
10,500	42,000	.001467	.000067	0.	.....	
10,750	43,000	.001500	.000033	.....	.....	
11,000	44,000	.001533	.000033	.....	.....	
11,250	45,000	.001567	.000034	.....	.....	
11,500	46,000	.001600	.000033	.....	.....	
11,750	47,000	.001667	.000067	.....	.....	
12,000	48,000	.001700	.000033	.....	.....	
12,250	49,000	.001733	.000033	.....	.....	
12,500	50,000	.001767	.000034	.....	.....	
12,750	51,000	.001800	.000033	.....	.....	
13,000	52,000	.001867	.000067	.....	.....	
13,250	53,000	.001900	.000033	.....	.....	Elastic limit.
13,500	54,000	.002000	.000100	.....	.....	
13,750	55,000	.009333	.007333	.....	.....	
14,000	56,000	.010000	.000667	.....	.....	
22,270	89,080	.1400	.1300	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89,080
Elastic limit per square inch of original section	do...	53,000
Elongation per inch after rupture	inch..	.2267
Elongation per inch under strain at elastic limit	do...	.001900
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1".5 from neck
Character of broken surface		silky
Elongation of inch sections		".17, ".37*, ".14

TABULATION OF TENSION SPECIMENS FROM 7-INCH B. L. SIEGE MORTARS (STEMS 3" LONG, ".564 DIAMETER).

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.	Remarks.
			Pounds.	*Pounds.*	*P. ct.*	*P. ct.*		
5647	Body No. 5....	Inside ..	51,000	96,240	15.7	21.4	Granular, radiating from a flaky spot at the circumference.	Breech end.
5693	Body No. 6....	....do ...	51,000	89,840	21.0	44.6	Silky	Do.
5694	Body No. 7....	Outside.	52,000	92,440	22.3	47.2	.....do	Muzzle end.
5692	Body No. 9....	....do ...	53,000	89,080	22.7	44.6	.....do	Do.

10-INCH STEEL B. L. RIFLES.

SPECIMENS FROM TUBES AND JACKETS.

TUBE.

No. 5536.

Marks, $\frac{7532\ B}{B\ T, M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000367	.000234	.....	.....	
5,000	20,000	.000700	.000333	.....	.....	
7,500	30,000	.001067	.000367	.....	.....	
8,750	35,000	.001267	.000200	0.	.....	
10,000	40,000	.001433	.000166	0.	.....	
10,250	41,000	.001467	.000034	.....	.....	
10,500	42,000	.001500	.000033	.....	.....	
10,750	43,000	.001533	.000033	.....	.....	
11,000	44,000	.001567	.000034	.....	.....	
11,250	45,000	.001600	.000033	.....	.....	
11,500	46,000	.001633	.000033	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	
12,000	48,000	.001733	.000066	.....	.....	Elastic limit.
12,250	49,000	.002067	.000334	.....	.....	
12,500	50,000	.004333	.002266	.....	.....	
12,750	51,000	.007467	.003134	.....	.....	
13,000	52,000	.008667	.001200	.....	.....	
13,250	53,000	.009800	.001133	.....	.....	
22,320	89,280	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89,280
Elastic limit per square inch of original section	do...	48,000
Elongation per inch after rupture	inch..	.2300
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1".6 from neck
Character of broken surface		silky
Elongation of inch sections		".14, ".39*, ".16

TUBE.

No. 5535.

Marks, $\frac{7532\ B_1}{M\ T_2\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001033	.000333	.....	.....	
8,750	35,000	.001200	.000167	0.	.....	
10,000	40,000	.001400	.000200	0.	.....	
10,250	41,000	.001433	.000033	.....	.....	
10,500	42,000	.001500	.000067	.....	.....	
10,750	43,000	.001533	.000033	.....	.....	
11,000	44,000	.001567	.000034	.....	.....	
11,250	45,000	.001633	.000066	.....	.....	
11,500	46,000	.001667	.000034	.....	.....	
11,750	47,000	.001700	.000033	.....	.....	
12,000	48,000	.001733	.000033	.....	.....	
12,250	49,000	.001767	.000034	.....	.....	Elastic limit.
12,500	50,000	.001900	.000133	.....	.....	
12,750	51,000	.003000	.001100	.....	.....	
13,000	52,000	.005333	.002333	.....	.....	
13,250	53,000	.006667	.001334	.....	.....	
13,500	54,000	.008167	.001500	.....	.....	
22,610	90,440	.1400	.131833	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	90,440
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.2000
Elongation per inch under strain at elastic limit	do...	.001767
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		".8 from neck
Character of broken surface		silky
Elongation of inch sections		".35*, ".14, ".11

TUBE.

No. 5555.

Marks, $\frac{7849\ B.}{B\ T.\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001100	.000400	.....	.....	
8,750	35,000	.001267	.000167	0.	.....	
10,000	40,000	.001433	.000166	.000033	.000033	
10,250	41,000	.001467	.000034	.....	.....	
10,500	42,000	.001500	.000033	.....	.....	
10,750	43,000	.001567	.000067	.....	.....	
11,000	44,000	.001633	.000066	.....	.....	
11,250	45,000	.001667	.000034	.....	.....	
11,500	46,000	.001733	.000066	.....	.....	Elastic limit.
11,750	47,000	.002000	.000267	.....	.....	
12,000	48,000	.002533	.000533	.....	.....	
12,250	49,000	.003100	.000567	.....	.....	
12,500	50,000	.004667	.001567	.....	.....	
12,750	51,000	.006500	.001833	.....	.....	
21,610	86,440	.1300	.1235	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	86,440
Elastic limit per square inch of original section	do...	46,000
Elongation per inch after rupture	inch..	.2233
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		".45 from neck
Character of broken surface		silky
Elongation of inch sections		".18, ".36, ".18

TUBE.

No. 5554.

Marks, $\frac{7849\ B_2}{M\ T_2 M}$.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001067	.000367	.....	.....	
8,750	35,000	.001200	.000133	0.	.....	
10,000	40,000	.001400	.000200	0.	.....	
10,250	41,000	.001467	.000067	.....	.....	
10,500	42,000	.001500	.000033	.....	.....	
10,750	43,000	.001567	.000067	.....	.....	
11,000	44,000	.001600	.000033	.....	.....	
11,250	45,000	.001633	.000033	.....	.....	
11,500	46,000	.001667	.000034	.....	.....	
11,750	47,000	.001733	.000066	.....	.....	
12,000	48,000	.001800	.000067	.....	.....	Elastic limit.
12,250	49,000	.002067	.000267	.....	.....	
12,500	50,000	.002433	.000366	.....	.....	
12,750	51,000	.003167	.000734	.....	.....	
13,000	52,000	.005500	.002333	.....	.....	
13,250	53,000	.006833	.001333	.....	.....	
22,190	88,760	.1533	.146467	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	88,760
Elastic limit per square inch of original section	do...	48,000
Elongation per inch after rupture	inch..	.2200
Elongation per inch under strain at elastic limit	do...	.001800
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1".25 from neck
Character of broken surface		silky
Elongation of inch sections		".12, ".20, ".34

TUBE.

No. 5582.

Marks, $\frac{7881\ B_1}{M\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001033	.000333	.....	.....	
8,750	35,000	.001200	.000167	0.	.....	
10,000	40,000	.001400	.000200	0.	.....	
10,250	41,000	.001433	.000033	.....	.....	
10,500	42,000	.001467	.000034	.....	.....	
10,750	43,000	.001500	.000033	.....	.....	
11,000	44,000	.001533	.000033	.....	.....	
11,250	45,000	.001567	.000034	.....	.....	
11,500	46,000	.001633	.000066	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	Elastic limit.
12,000	48,000	.001767	.000100	.....	.....	
12,250	49,000	.002333	.000566	.....	.....	
12,500	50,000	.004667	.002334	.....	.....	
12,750	51,000	.005833	.001166	.....	.....	
13,000	52,000	.007333	.001500	.....	.....	
21,910	87,640	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	87,640
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.2400
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1″.6 from neck
Character of broken surface		silky
Elongation of inch sections		″.15, ″.38*, ″.19

TUBE.

No. 5583.

Marks, $\frac{7881\ B}{B\ T, M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001067	.000367	.....	.....	
8,750	35,000	.001233	.000166	0.	.....	
10,000	40,000	.001433	.000200	0.	.....	
10,250	41,000	.001467	.000034	.....	.....	
10,500	42,000	.001500	.000033	.....	.....	
10,750	43,000	.001533	.000033	.....	.....	
11,000	44,000	.001600	.000067	.....	.....	
11,250	45,000	.001633	.000033	.....	.....	Elastic limit.
11,500	46,000	.001733	.000100	.....	.....	
11,750	47,000	.001967	.000234	.....	.....	
12,000	48,000	.002800	.000833	.....	.....	
12,250	49,000	.004000	.001200	.....	.....	
12,500	50,000	.005333	.001333	.....	.....	
21,880	87,520	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	87,520
Elastic limit per square inch of original section	do...	45,000
Elongation per inch after rupture	inch..	.2333
Elongation per inch under strain at elastic limit	do...	.001633
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1″.5 from neck
Character of broken surface		silky
Elongation of inch sections		″.19, ″.36*, ″.12

TUBE.

No. 5588.

Marks, $\frac{7932\ B}{M\ T, M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001033	.000333	.....	.....	
8,750	35,000	.001300	.000267	0.	.....	
10,000	40,000	.001433	.000133	.000033	.000033	
10,250	41,000	.001500	.000067	.....	.....	
10,500	42,000	.001533	.000033	.....	.....	
10,750	43,000	.001567	.000034	.....	.....	
11,000	44,000	.001600	.000033	.....	.....	
11,250	45,000	.001633	.000033	.....	.....	
11,500	46,000	.001700	.000067	.....	.....	Elastic limit
11,750	47,000	.001800	.000100	.....	.....	
		.002833	.001033	.....	.....	
12,000	48,000	.005200	.002367	.....	.....	
12,250	49,000	.006167	.000967	.....	.....	
12,500	50,000	.007167	.001000	.....	.....	
17,750	51,000	.009033	.000866	.....	.....	
21,420	85,680	.1467	.138667	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	85,680
Elastic limit per square inch of original section	do...	46,000
Elongation per inch after rupture	inch..	.2233
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		″.14, ″.39*, ″.14

TUBE.

No. 5589.

Marks, $\frac{7932\ B}{B\ T, M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000733	.000400	.....	.....	
7,500	30,000	.001100	.000367	.....	.....	
8,750	35,000	.001300	.000200	.000033	.000033	
10,000	40,000	.001567	.000267	.000100	.000067	
10,250	41,000	.001633	.000066	.....	.....	
10,500	42,000	.001667	.000034	.....	.....	Elastic limit.
10,750	43,000	.001767	.000100	.....	.....	
11,000	44,000	.001900	.000133	.....	.....	
11,250	45,000	.002333	.000433	.....	.....	
11,500	46,000	.003000	.000667	.....	.....	
11,750	47,000	.003833	.000833	.....	.....	
22,430	89,720	.1533	.149467	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89,720
Elastic limit per square inch of original section	do...	42,000
Elongation per inch after rupture	inch..	.2033
Elongation per inch under strain at elastic limit	do....	.001667
Reduction in diameter at point of rupture	do....	.134
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		1″.5 from neck
Character of broken surface		silky, 30 per cent interspersed with fine granulation
Elongation of inch sections		.″14, .″32*, .″15

TUBE.

No. 5592.

Marks, $\frac{7982\ B_1}{B\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0	0.	Initial load.
1,250	5,000	.000133	.000133	0	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001067	.000367	.....	.....	
8,750	35,000	.001267	.000200	0.	.....	
10,000	40,000	.001467	.000200	.000033	.000033	
10,250	41,000	.001500	.000033	.....	.....	
10,500	42,000	.001533	.000033	.....	.....	Elastic limit.
10,750	43,000	.001633	.000100	.....	.....	
11,000	44,000	.001933	.000300	.....	.....	
11,250	45,000	.002333	.000400	.....	.....	
11,500	46,000	.003500	.001167	.....	.....	
11,750	47,000	.004000	.000500	.....	.....	
21,420	85,680	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	85,680
Elastic limit per square inch of original section	do...	42,000
Elongation per inch after rupture	inch..	.1700
Elongation per inch under strain at elastic limit	do...	.001533
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		″.09, ″.33*, ″.09

TUBE.

No. 5561.

Marks, $\frac{7953\ B}{B\ T,\ M}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001033	.000366	.....	.....	
8,750	35,000	.001200	.000167	0.	.....	
10,000	40,000	.001367	.000167	0.	.....	
10,250	41,000	.001400	.000033	.....	.....	
10,500	42,000	.001433	.000033	.....	.....	
10,750	43,000	.001500	.000067	.....	.....	
11,000	44,000	.001533	.000033	.....	.....	
11,250	45,000	.001567	.000034	.....	.....	
11,500	46,000	.001633	.000066	.....	.....	Elastic limit.
11,750	47,000	.006000	.004367	.....	.....	
12,000	48,000	.007000	.001000	.....	.....	
12,250	49,000	.007500	.000500	.....	.....	
12,500	50,000	.008667	.001167	.....	.....	
12,750	51,000	.009300	.000633	.....	.....	
21,610	86,440	.1567	.1474	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	86,440
Elastic limit per square inch of original section	do...	46,000
Elongation per inch after rupture	inch..	.2400
Elongation per inch under strain at elastic limit	do...	.001633
Reduction in diameter at point of rupture	do...	.155
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1″.6 from neck
Character of broken surface		silky
Elongation of inch section		″.18 ″.40*, ″.14

JACKET.

No. 5550.

Marks, $\frac{7662\ B}{B\ T,\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001033	.000333	.....	.....	
8,750	35,000	.001233	.000200	.000033	.000033	
10,000	40,000	.001433	.000200	.....	.....	
10,500	42,000	.001533	.000100	.000067	.000034	
10,750	43,000	.001567	.000034	.....	.....	
11,000	44,000	.001600	.000033	.....	.....	
11,250	45,000	.001633	.000033	.....	.....	
11,500	46,000	.001667	.000034	.....	.....	
11,750	47,000	.001700	.000033	.....	.....	
12,000	48,000	.001733	.000033	.....	.....	
12,250	49,000	.001767	.000034	.....	.....	
12,500	50,000	.001833	.000066	.....	.....	
12,750	51,000	.001867	.000034	.....	.....	Elastic limit.
13,000	52,000	.002033	.000166	.....	.....	
13,250	53,000	.002400	.000367	.....	.....	
13,500	54,000	.004300	.001900	.....	.....	
13,750	55,600	.005000	.000700	.....	.....	
14,000	56,000	.006200	.001200	.....	.....	
23,810	95,240	.1300	.1238	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	95,240
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.1933
Elongation per inch under strain at elastic limit	do...	.001867
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.22 from neck
Character of broken surface		silky
Elongation of inch sections		″.11, ″.25*, ″.22

JACKET.

No. 5549

Marks, $\frac{7662\ B_2}{M\ T_2\ M.}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	.....	.....	
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001167	.000167	.....	.....	
10,000	40,000	.001367	.000200	.....	.....	
10,500	42,000	.001433	.000066	.....	.....	
10,750	43,000	.001467	.000034	.....	.....	
11,000	44,000	.001500	.000033	.....	.....	
11,250	45,000	.001533	.000033	.....	.....	
11,500	46,000	.001567	.000034	.....	.....	
11,750	47,000	.001600	.000033	.....	.....	
12,000	48,000	.001633	.000033	.....	.....	
12,250	49,000	.001667	.000034	.....	.....	
12,500	50,000	.001733	.000066	.....	.....	Elastic limit.
12,750	51,000	.001833	.000100	.....	.....	
13,000	52,000	.005333	.003500	.....	.....	
13,250	53,000	.005667	.000334	.....	.....	
13,500	54,000	.006667	.001000	.....	.....	
13,750	55,000	.007667	.001000	.....	.....	
22,770	91,080	.1267	.119033	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	91,080
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.2000
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		".11, ".37*, ".12

JACKET.

No. 5563.

Marks, $\frac{7662\ B_1}{B\ T_2\ M.}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001033	.000366	.....	.....	
8,750	35,000	.001200	.000167	0.	.....	
10,000	40,000	.001367	.000167	.....	.....	
10,500	42,000	.001467	.000100	0.	.....	
10,750	43,000	.001500	.000033	.....	.....	
11,000	44,000	.001533	.000033	.....	.....	
11,250	45,000	.001567	.000034	.....	.....	
11,500	46,000	.001600	.000033	.....	.....	
11,750	47,000	.001633	.000033	.....	.....	Elastic limit.
12,000	48,000	.001833	.000200	.....	.....	
12,250	49,000	.003000	.001167	.....	.....	
12,500	50,000	.006667	.003667	.....	.....	
12,750	51,000	.007333	.000666	.....	.....	
13,000	52,000	.008167	.000834	.....	.....	
22,430	89,720	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89,720
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.2000
Elongation per inch under strain at elastic limit	do...	.001633
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		".60 from neck
Character of broken surface		silky
Elongation of inch sections		".11, ".14, ".35*

JACKET.

No. 5564.

Marks, $\frac{7662\ B}{M\ T_2\ M}$.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001033	.000366	.....	.....	
8,750	35,000	.001200	.000167	0.	.....	
10,000	40,000	.001367	.000167	.....	.....	
10,500	42,000	.001467	.000100	0.	.....	
10,750	43,000	.001500	.000033	.....	.....	
11,000	44,000	.001567	.000067	.....	.....	
11,250	45,000	.001600	.000033	.....	.....	
11,500	46,000	.001633	.000033	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	Elastic limit.
12,000	48,000	.001800	.000133	.....	.....	
12,250	49,000	.001967	.000167	.....	.....	
12,500	50,000	.002467	.000500	.....	.....	
12,750	51,000	.003333	.000866	.....	.....	
13,000	52,000	.005167	.001834	.....	.....	
22,810	91,240	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	91,240
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.2067
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		".75 from neck
Character of broken surface		silky
Elongation of inch sections		".34", ".16, ".12

JACKET.

No. 5586.

Marks, $\frac{8038\ B}{M\ T,\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001067	.000367	.....	.....	
8,750	35,000	.001233	.000166	0.	.....	
10,000	40,000	.001433	.000200	.....	.....	
10,500	42,000	.001500	.000067	.000033	.000033	
10,750	43,000	.001533	.000033	.....	.....	
11,000	44,000	.001600	.000067	.....	.....	
11,250	45,000	.001633	.000033	.....	.....	
11,500	46,000	.001667	.000034	.....	.....	
11,750	47,000	.001700	.000033	.....	.....	Elastic limit.
12,000	48,000	.007333	.005633	.....	.....	
12,250	49,000	.007833	.000500	.....	.....	
12,500	50,000	.008833	.001000	.....	.....	
12,750	51,000	.009700	.000867	.....	.....	
21,320	85,280	.1700	.1603	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	85,280
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.1767
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.074
Reduction in area after rupture, per cent of original section		24.6
Position of rupture		1″ from neck
Character of broken surface		granular, radiating from an oblique flaky spot at circumference
Elongation of inch sections		″.15, ″.16, ″.22

JACKET.

No. 5587.

Marks, $\frac{8038\ B_1}{B\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001200	.000200	0.	.....	
10,000	40,000	.001367	.000167	.....	.....	
10,500	42,000	.001433	.000066	0.	.....	
10,750	43,000	.001500	.000067	.....	.....	
11,000	44,000	.001533	.000033	.....	.....	
11,250	45,000	.001567	.000034	.....	.....	
11,500	46,000	.001633	.000066	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	Elastic limit.
12,000	48,000	.001800 .005000	.000133 .003200	.....	.....	
12,250	49,000	.005367	.000367	.....	.....	
12,500	50,000	.006533	.001166	.....	.....	
12,750	51,000	.007167	.000634	.....	.....	
13,000	52,000	.008500	.001333	.....	.....	
21,740	86,960	.1400	.1315	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	86,960
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.2300
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		″.14, ″.39*, ″.18

JACKET.

No. 5617.

Marks, $\frac{7866\ B}{B\ T, M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000700	.000400	.....	.....	
7,500	30,000	.001067	.000367	.....	.....	
8,750	35,000	.001233	.000166	0.	.....	
10,000	40,000	.001467	.000234	.....	.....	
10,500	42,000	.001533	.000066	.000033	.000033	
10,750	43,000	.001600	.000067	.....	.....	
11,000	44,000	.001667	.000067	.....	.....	Elastic limit.
11,250	45,000	.001767	.000100	.....	.....	
		.006467	.004700	.....	.....	
11,500	46,000	.007000	.000533	.....	.....	
11,750	47,000	.007667	.000667	.....	.....	
12,000	48,000	.008600	.000933	.....	.....	
12,250	49,000	.009600	.001000	.....	.....	
21,320	85,280	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	85,280
Elastic limit per square inch of original section	do...	44,000
Elongation per inch after rupture	inch..	.2800
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	".144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		".17, ".41, ".16

JACKET.

No. 5635.

Marks, $\frac{8038\ B,}{B\ T,M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Succe-sive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001033	.000333	.....	.....	
8,750	35,000	.001200	.000167	0.	.....	
10,000	40,000	.001400	.000200	.....	.....	
10,500	42,000	.001467	.000067	.000033	.000033	
10,750	43,000	.001500	.000033	.....	.....	
11,000	44,000	.001533	.000033	.....	.....	
11,250	45,000	.001567	.000034	.....	.....	
11,500	46,000	.001600	.000033	.....	.....	
11,750	47,000	.001633	.000033	.....	.....	
12,000	48,000	.001667	.000034	.....	.....	Elastic limit.
12,250	49,000	.003100	.001433	.....	.....	
12,500	50,000	.006667	.003567	.....	.....	
12,750	51,000	.007267	.000600	.....	.....	
13,000	52,000	.008000	.000733	.....	.....	
13,250	53,000	.009067	.001067	.....	.....	
22,190	88,760	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	88,760
Elastic limit per square inch of original section	do...	48,000
Elongation per inch after rupture	inch..	.2230
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.085
Reduction in area after rupture, per cent of original section		30.7
Position of rupture		".85 from neck
Character of broken surface		silky
Elongation of inch sections		".14, ".16, ".37*

JACKET.

No. 5662.

Marks, $\frac{8487\ B_1}{B\ T_s\ M}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000367	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001367	.000200	.....	.....	
10,500	42,000	.001467	.000100	0.	.....	
10,750	43,000	.001500	.000033	.....	.....	
11,000	44,000	.001533	.000033	.....	.....	
11,250	45,000	.001567	.000034	.....	.....	
11,500	46,000	.001633	.000066	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	
12,000	48,000	.001733	.000066	.....	.....	Elastic limit.
12,250	49,000	.003167	.001434	.....	.....	
12,500	50,000	.004833	.001666	.....	.....	
12,750	51,000	.006667	.001834	.....	.....	
13,000	52,000	.007333	.000666	.....	.....	
13,250	53,000	.008333	.001000	.....	.....	
22,710	90,840	.1333	.124967	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	90,840
Elastic limit per square inch of original section	do...	48,000
Elongation per inch after rupture	inch..	.2200
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.165
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1″.27 from neck
Character of broken surface		silky
Elongation of inch sections		″.31*, ″.24, ″.11

TABULATION OF TENSION SPECIMENS FROM 10-INCH STEEL B. L. RIFLES.
(STEMS 3" LONG, ".564 DIAMETER.)

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.	Remarks.
			Pounds.	*Pounds.*	*Pr. ct.*	*Pr. ct.*		
5536	Tube	Middle	48,000	89,280	23.0	47.2	Silky	Breech end.
5535	do	do	49,000	90,440	20.0	44.6	do	Muzzle end.
5555	do	do	46,000	86,440	22.3	49.7	do	Breech end.
5554	do	do	48,000	88,760	22.0	49.7	do	Muzzle end.
5582	do	do	47,000	87,640	24.0	49.7	do	Do.
5583	do	do	45,000	87,520	22.3	49.7	do	Breech end.
5588	do	do	46,000	85,680	22.3	49.7	do	Muzzle end.
5589	do	do	42,000	89,720	20.3	41.9	Silky, 30 per cent interspersed with fine granulation.	Breech end.
5592	do	do	42,000	85,680	17.0	49.7	Silky	Do.
5661	do	do	46,000	86,440	24.0	47.2	do	Do.
5550	Jacket	do	51,000	95,240	19.3	44.6	do	Do.
5549	do	do	50,000	91,080	20.0	47.2	do	Muzzle end.
5563	do	do	47,000	89,720	20.0	44.6	do	Breech end.
5564	do	do	47,000	91,240	20.7	39.2	do	Muzzle end.
5586	do	do	47,000	85,280	17.7	24.6	Granular, radiating from an oblique flaky spot at the circumference.	Do.
5587	do	do	47,000	86,960	23.0	47.2	Silky	Breech end.
5617	do	do	44,000	85,280	28.0	44.6	do	Do.
5635	do	do	48,000	88,760	22.3	30.7	do	Do.
5662	do	do	48,000	90,840	22.0	49.7	do	Do.

12-INCH STEEL B. L. RIFLES.

SPECIMENS FROM TUBES AND JACKETS.

TUBE NO. 13.

No. 5566.

Marks, $\frac{12\ R_{12}\ T}{B\ T,\ O}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	0.	.....	
10,250	41,000	.001333	.000033	.....	.....	
10,500	42,000	.001367	.000034	.....	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001500	.000033	.....	.....	
11,750	47,000	.001533	.000033	.....	.....	
12,000	48,000	.001600	.000067	.....	.....	Elastic limit.
12,250	49,000	.001800	.000200	.....	.....	
12,500	50,000	.002533	.000733	.....	.....	
12,750	51,000	.003467	.000934	.....	.....	
13,000	52,000	.004800	.001333	.....	.....	
13,250	53,000	.005800	.001000	.....	.....	
22,270	89,080	.1467	.1409	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89,080
Elastic limit per square inch of original section	do...	48,000
Elongation per inch after rupture	inch..	.1900
Elongation per inch under strain at elastic limit	do...	.001600
Reduction in diameter at point of rupture	do...	.094
Reduction in area after rupture, per cent of original section		30.6
Position of rupture		1".6 from neck
Character of broken surface		granular, radiating from a dull silky spot at the circumference
Elongation of inch sections		".12, ".29*, ".16

TUBE No. 13.

No. 5565.

Marks, $\overset{12\ R\ 13\ T}{M\ T,\ O}$
Diameter, ".564.
Sectional area, .25 square inch
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20 000	.000700	.000367	.....	.....	
7,500	30,000	.001033	.000333	.....	.....	
8,750	35,000	.001200	.000167	0.	.....	
10,000	40,000	.001367	.000167	0.	.....	
10,250	41,000	.001433	.000066	.....	.....	
10,500	42,000	.001467	.000034	.....	.....	Elastic limit.
10,750	43,000	.010000	.008534	.....	.....	
11,250	45,000	.0133	.0033	.....	.....	
11,750	47,000	.0167	.0034	.....	.....	
12,500	50,000	.0200	.0033	.....	.....	
19,610	78,440	.1700	.1500	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	78,440
Elastic limit per square inch of original section	do...	42,000
Elongation per inch after rupture	inch..	.1833
Elongation per inch under strain at elastic limit	do...	.001467
Reduction in diameter at point of rupture	do...	.094
Reduction in area after rupture, per cent of original section		30.6
Position of rupture		".6 from neck
Character of broken surface		granular, belt of flaky metal extending across fractured surface; opened cracks in surface of stem near the place of fracture.
Elongation of inch sections		".13, ".16, ".26*

TUBE.

No. 5590.

Marks, $\frac{8326\ B_1}{M\ T_2\ M}$
Diameter, ″.559.
Sectional area, .245 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
245	1,000	0.	0.	0.	0.	Initial load.
1,225	5,000	.000133	.000133	.....	.....	
2,450	10,000	.000333	.000200	.....	.....	
4,900	20,000	.000700	.000367	.....	.....	
7,350	30,000	.001067	.000367	.....	.....	
8,575	35,000	.001233	.000166	0.	.....	Elastic limit below 40,000 pounds per square inch.
9,800	40,000	.001633	.000400	.000267	.000267	
10,045	41,000	.002500	.000867	.....	.....	
10,290	42,000	.004333	.001833	.....	.....	
10,535	43,000	.005500	.001167	.....	.....	
10,780	44,000	.006333	.000833	.....	.....	
19,780	80,730	.1467	.140367	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	80,730
Elastic limit per square inch of original section	pounds..	below 40,000
Elongation per inch after rupture	inch..	.2267
Reduction in diameter at point of rupture	do...	.149
Reduction in area after rupture, per cent of original section		46.1
Position of rupture		1″.6 from neck
Character of broken surface		silky
Elongation of inch sections		″.18, ″.37*, ″.13

TUBE.

No. 5591.

Marks, $\frac{8326\ B}{B\ T,\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001100	.000400	.....	.....	
8,750	35,000	.001267	.000167	.000033	.000033	
10,000	40,000	.001467	.000200	.000033	0.	
10,250	41,000	.001500	.000033	.....	.....	
10,500	42,000	.001567	.000067	.....	.....	
10,750	43,000	.001600	.000033	.....	.....	
11,000	44,000	.001633	.000033	.....	.....	
11,250	45,000	.001667	.000034	.....	.....	Elastic limit.
11,500	46,000	.007500	.005833	.....	.....	
11,750	47,000	.008067	.000567	.....	.....	
12,000	48,000	.009000	.000933	.....	.....	
12,350	49,000	.010067	.001067	.....	.....	
22,360	89,440	.1533	.143233	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89,440
Elastic limit per square inch of original section	do...	45,000
Elongation per inch after rupture	inch..	.2567
Elongation per inch under strain at elastic limit	do....	.001667
Reduction in diameter at point of rupture	do...	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		".85 from neck
Character of broken surface		silky
Elongation of inch sections		".39*, ".23, ".15

TUBE No. 19.

No. 5712.

Marks, $^{12}_{B}\,B_{T_1}\,^{19}_{O}\,T$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001033	.000333	.....	.....	
8,750	35,000	.001233	.000200	0.	.....	
10,000	40,000	.001400	.000167	0.	.....	
10,250	41,000	.001433	.000033	.....	.....	
10,500	42,000	.001467	.000034	.....	.....	
10,750	43,000	.001500	.000033	.....	.....	
11,000	44,000	.001533	.000033	.....	.....	
11,250	45,000	.001600	.000067	.....	.....	
11,500	46,000	.001633	.000033	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	
12,000	48,000	.001700	.000033	.....	.....	
12,250	49,000	.001733	.000033	.....	.....	Elastic limit.
12,500	50,000	.001967	.000234	.....	.....	
12,750	51,000	.002067	.000100	.....	.....	
13,000	52,000	.003333	.001266	.....	.....	
13,250	53,000	.005333	.002000	.....	.....	
13,500	54,000	.006833	.001500	.....	.....	
22,710	90,840	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	90,840
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.2133
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1".2 from neck
Character of broken surface		silky, oblique
Elongation of inch sections		".28*, ".25, ".11

JACKET NO. 13.

No. 5567.

Marks, $\frac{12\ R_{12}\ J}{B\ T_6\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000733	.000400	.....	.....	
7,500	30,000	.001067	.000334	.....	.....	
8,750	35,000	.001267	.000200	.000033	.000033	
10,000	40,000	.001433	.000166	.....	.....	
10,500	42,000	.001500	.000067	.000033	0.	
11,000	44,000	.001567	.000067	.....	.....	
11,500	46,000	.001633	.000066	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	
12,000	48,000	.001667	0.	.....	.....	
12,250	49,000	.001733	.000066	.....	.....	
12,500	50,000	.001767	.000034	.....	.....	
12,750	51,000	.001800	.000033	.....	.....	
13,000	52,000	.001833	.000033	.....	.....	
13,250	53,000	.001867	.000034	.....	.....	
13,500	54,000	.001933	.000066	.....	.....	
13,750	55,000	.001967	.000034	.....	.....	
14,000	56,000	.002000	.000033	.....	.....	
14,250	57,000	.002067	.000067	.....	.....	
14,500	58,000	.002133	.000066	.....	.....	Elastic limit
14,750	59,000	.002500	.000367	.....	.....	
15,000	60,000	.004333	.001833	.....	.....	
15,250	61,000	.005333	.001000	.....	.....	
15,500	62,000	.006000	.000667	.....	.....	
15,750	63,000	.007333	.001333	.....	.....	
24,960	99,840	.1200	.112667	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	99,840
Elastic limit per square inch of original section	do...	58,000
Elongation per inch after rupture	inch..	.1967
Elongation per inch under strain at elastic limit	do...	.002133
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1″.49 from neck
Character of broken surface		silky
Elongation of inch sections		″.13, ″.36*, ″.10

JACKET NO. 13.

No. 5568.

Marks, $\frac{12\ R_{13}\ J}{M\ T_1\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000167	.000167	0.	.....	
2,500	10,000	.000333	.000166	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001000	.000300	.....	.....	
8,750	35,000	.001200	.000200	0.	.....	
10,000	40,000	.001367	.000167	.....	.....	
10,500	42,000	.001433	.000066	0.	.....	
10,750	43,000	.001467	.000034	.....	.....	
11,000	44,000	.001500	.000033	.....	.....	
11,250	45,000	.001533	.000033	.....	.....	
11,500	46,000	.001567	.000034	.....	.....	
11,750	47,000	.001600	.000033	.....	.....	
12,000	48,000	.001667	.000067	.....	.....	
12,250	49,000	.001667	0.	.....	.....	
12,500	50,000	.001700	.000033	.....	.....	
12,750	51,000	.001733	.000033	.....	.....	
13,000	52,000	.001767	.000034	.....	.....	
13,250	53,000	.001833	.000066	.....	.....	Elastic limit.
13,500	54,000	.002167	.000334	.....	.....	
13,750	55,000	.010000	.007833	.....	.....	
21,910	87,640	.1500	.1400	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	87,640
Elastic limit per square inch of original section	do...	53,000
Elongation per inch after rupture	inch..	.2167
Elongation per inch under strain at elastic limit	do...	.001833
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1″.43 from neck
Character of broken surface		silky, trace of granulation
Elongation of inch sections		″.22, ″.32*, ″.11

JACKET No. 18.

No. 5674.

Marks, $\frac{12\ R\ 18\ J}{M\ T,\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	.....	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000733	.000400	.....	.....	
7,500	30,000	.001100	.000367	.....	.....	
8,750	35,000	.001267	.000167	.000067	.000067	
10,000	40,000	.001500	.000233	.....	.....	
10,500	42,000	.001567	.000067	.000067	0.	
10,750	43,000	.001600	.000033	.....	.....	
11,000	44,000	.001633	.000033	.....	.....	
11,250	45,000	.001667	.000034	.....	.....	
11,500	46,000	.001700	.000033	.....	.....	
11,750	47,000	.001733	.000033	.....	.....	
12,000	48,000	.001767	.000034	.....	.....	
12,250	49,000	.001800	.000033	.....	.....	
12,500	50,000	.001833	.000033	.....	.....	
12,750	51,000	.001867	.000034	.....	.....	
13,000	52,000	.001933	.000066	.....	.....	
13,250	53,000	.002000	.000067	.....	.....	Elastic limit.
13,500	54,000	.002133	.000133	.....	.....	
13,750	55,000	.002333	.000200	.....	.....	
14,000	56,000	.002800	.000467	.....	.....	
14,250	57,000	.005167	.002367	.....	.....	
14,500	58,000	.006533	.001366	.....	.....	
23,820	95,280	.1400	.133467	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	95,280
Elastic limit per square inch of original section	do...	53,000
Elongation per inch after rupture	inch..	.2267
Elongation per inch under strain at elastic limit	do...	.002000
Reduction in diameter at point of rupture	do...	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		1″.7 from neck
Character of broken surface		silky
Elongation of inch sections		″.14, ″.39*, ″.15

JACKET No. 19.

No. 5713.

Marks, $\frac{12\ R\ 19\ J}{B\ T,\ O}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads. Total.	Applied loads. Per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001333	.000166	.....	.....	
10,500	42,000	.001400	.000067	0.	.....	
12,500	50,000	.001667	.000267	.....	.....	
13,750	55,000	.001833	.000166	.....	.....	
14,000	56,000	.001867	.000034	.....	.....	
14,250	57,000	.001900	.000033	.....	.....	
14,500	58,000	.001967	.000067	.....	.....	
14,750	59,000	.002000	.000033	.....	.....	
15,000	60,000	.002067	.000067	.....	.....	Elastic limit.
15,250	61,000	.002733	.000666	.....	.....	
15,500	62,000	.004500	.001767	.....	.....	
15,750	63,000	.005667	.001167	.....	.....	
16,000	64,000	.006667	.001000	.....	.....	
16,250	65,000	.007367	.000700	.....	.....	
25,420	101,680	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	101,680
Elastic limit per square inch of original section	do...	60,000
Elongation per inch after rupture	inch..	.1967
Elongation per inch under strain at elastic limit	do...	.002067
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1".1 from neck
Character of broken surface		silky, trace of granulation
Elongation of inch sections		".10, ".18, ".31*

TABULATION OF TENSION SPECIMENS FROM 12-INCH STEEL B. L. RIFLES (STEMS, 3" LONG, ".564 DIAMETER).

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.	Remarks.
			Pounds.	*Pounds.*	*Pr. ct.*	*Pr. ct.*		
5566	Tube No. 13...	Outside.	48,000	89,080	19.0	30.6	Granular, radiating from a dull silky spot at circumference.	Breech end.
5565	.....do	....do ...	42,000	78,440	18.3	30.6	Granular, belt of flaky metal extending across fractured surface.	Muzzle end.
5591	Tube	Middle .	{Below 40,000}	80,780	22.7	46.1	Silky	Do.
5591	.....do	....do ...	45,000	89,440	25.7	52.2	.... do	Breech end.
5712	Tube No. 19...	Outside.	49,000	90,840	21.3	47.2	Silky, oblique.....	Do.
5567	Jacket No. 13 .	....do ...	58,000	99,840	19.7	47.2	Silky	Do.
5568	.....do	....do ...	53,000	87,640	21.7	47.2	Silky, trace of granulation.	Muzzle end.
5674	Jacket No. 18 .	....do ...	53,000	95,280	22.7	37.1	Silky	Do.
5713	Jacket No. 19 .	....do ...	60,000	101,680	19.7	44.6	Silky, trace of granulation.	Breech end.

12-INCH B. L. RIFLED MORTARS.

SPECIMENS FROM TUBES AND JACKETS.

TUBE.

No. 5557.

Marks, $\frac{7859\ B_1}{B\ T,\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.		
2,500	10,000	.000367	.000234	.....	.....	
5,000	20,000	.000767	.000400	.....	.....	
7,500	30,000	.001133	.000366	.....	.....	
8,750	35,000	.001300	.000167	.000033	.000033	
10,000	40,000	.001533	.000233	.000033	0.	
10,250	41,000	.001567	.000034	.....	.....	
10,500	42,000	.001633	.000066	.....	.....	
10,750	43,000	.001667	.000034	.....	.....	
11,000	44,000	.001700	.000033	.....	.....	
11,250	45,000	.001733	.000033	.....	.....	
11,500	46,000	.001767	.000034	.....	.....	Elastic limit.
11,750	47,000	.001933	.000166	.....	.....	
12,000	48,000	.006167	.004234	.....	.....	
12,250	49,000	.006667	.000500	.....	.....	
12,500	50,000	.007800	.001133	.....	.....	
12,750	51,000	.008500	.000700	.....	.....	
21,430	85,720	.1500	.1415	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	85,720
Elastic limit per square inch of original section	do...	46,000
Elongation per inch after rupture	inch..	.2433
Elongation per inch under strain at elastic limit	do...	.001767
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		at middle of stem
Character of broken surface		silky, minute cracks developed in surface of stem
Elongation of inch sections		".15, ".41*, ".17

TUBE.

No. 5556.

Marks, $\frac{7859\ B}{M\ T}$, $\frac{}{M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, ″3.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000633	.000300	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001167	.000200	0.	.....	
10,000	40,000	.001367	.000200	0.	.....	
10,250	41,000	.001400	.000033	.....	.....	
10,500	42,000	.001433	.000033	.....	.....	
10,750	43,000	.001467	.000034	.....	.....	
11,000	44,000	.001533	.000066	.....	.....	
11,250	45,000	.001567	.000034	.....	.....	
11,500	46,000	.001600	.000033	.....	.....	
11,750	47,000	.001633	.000033	.....	.....	
12,000	48,000	.001700	.000067	.....	.....	Elastic limit.
12,250	49,000	.001867	.000167	.....	.....	
12,500	50,000	.002900	.001033	.....	.....	
12,750	51,000	.004500	.001600	.....	.....	
13,000	52,000	.005500	.001000	.....	.....	
13,250	53,000	.006500	.001000	.....	.....	
22,210	88,840	.1400	.1335	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	88,840
Elastic limit per square inch of original section	do...	48,000
Elongation per inch after rupture	inch..	.2400
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		″1.12 from neck
Character of broken surface... silky, opened cracks in surface of stem in vicinity of place of rupture		
Elongation of inch sections		″.34*, ″.20, ″.18

TUBE.

No. 5559.

Marks, $\frac{5925\ B_1\ F_2}{B\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.		
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000367	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001400	.000233	0.	.....	
10,250	41,000	.001467	.000067	.....	.....	
10,500	42,000	.001500	.000033	.....	.....	
10,750	43,000	.001533	.000033	.....	.....	
11,000	44,000	.001600	.000067	.....	.....	
11,250	45,000	.001633	.000033	.....	.....	
11,500	46,000	.001667	.000034	.....	.....	
11,750	47,000	.001733	.000066	.....	.....	
12,000	48,000	.001800	.000067	.....	.....	Elastic limit.
12,250	49,000	.002067	.000267	.....	.....	
12,500	50,000	.002500	.000433	.....	.....	
12,750	51,000	.003000	.000500	.....	.....	
13,000	52,000	.004333	.001333	.....	.....	
13,250	53,000	.005500	.001167	.....	.....	
22,690	90,760	.1167	.1112	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	90,760
Elastic limit per square inch of original section	do...	48,000
Elongation per inch after rupture	inch..	.2067
Elongation per inch under strain at elastic limit	do...	.001800
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1″.7 from neck
Character of broken surface		silky
Elongation of inch sections		″.11, ″.38*, ″.13

TUBE.

No. 5558.

Marks, $\frac{5925\ B_1\ F_2}{M\ T_2\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch	Successive elongation per inch	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000400	.000267	.....	.....	
5,000	20,000	.000733	.000333	.....	.....	
7,500	30,000	.001100	.000367	.....	.....	
8,750	35,000	.001267	.000167	0.	.....	
10,000	40,000	.001433	.000166	0.	.....	
10,250	41,000	.001467	.000034	.....	.....	
10,500	42,000	.001500	.000033	.....	.....	
10,750	43,000	.001533	.000033	.....	.....	
11,000	44,000	.001567	.000034	.....	.....	
11,250	45,000	.001600	.000033	.....	.....	
11,500	46,000	.001633	.000033	.....	.....	
11,750	47,000	.001700	.000067	.....	.....	
12,000	48,000	.001767	.000067	.....	.....	
12,250	49,000	.001833	.000066	.....	.....	Elastic limit.
12,500	50,000	.002233	.000400	.....	.....	
12,750	51,000	.003933	.001700	.....	.....	
13,000	52,000	.005333	.001400	.....	.....	
13,250	53,000	.006167	.000834	.....	.....	
13,500	54,000	.007500	.001333	.....	.....	
22,410	89,640	.1300	.1225	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89,640
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.2000
Elongation per inch under strain at elastic limit	do...	.001833
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		".16 from neck
Character of broken surface		silky, oblique
Elongation of inch sections		".15, ".35*, ".10

TUBE.

No. 5570.

Marks, $\frac{7863\ B_1}{B\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001033	.000366	.....	.....	
8,750	35,000	.001200	.000167	0.	.....	
10,000	40,000	.001400	.000200	0.	.....	
10,250	41,000	.001433	.000033	.....	.....	
10,500	42,000	.001467	.000034	.....	.....	
10,750	43,000	.001533	.000066	.....	.....	
11,000	44,000	.001600	.000067	.....	.....	Elastic limit.
11,250	45,000	.002333	.000733	.....	.....	
11,500	46,000	.004833	.002500	.....	.....	
11,750	47,000	.005767	.000934	.....	.....	
12,000	48,000	.006833	.001066	.....	.....	
12,250	49,000	.007500	.000667	.....	.....	
21,440	85,760	.1300	.1225	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	85,760
Elastic limit, per square inch of original section	do...	44,000
Elongation per inch after rupture	inch..	.2267
Elongation per inch under strain at elastic limit	do...	.001600
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1″.3 from neck
Character of broken surface		silky
Elongation of inch sections		″.24, ″.28*, ″.16

TUBE.

No. 5569.

Marks, $\frac{7863\ B}{M\ T,M}$
Diameter, ".565.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001067	.000367	.....	.....	
8,750	35,000	.001233	.000166	0.	.....	
10,000	40,000	.001400	.000167	0.	.....	
10,250	41,000	.001433	.000033	.....	.....	
10,500	42,000	.001467	.000034	.....	.....	
10,750	43,000	.001500	.000033	.....	.....	
11,000	44,000	.001533	.000033	.....	.....	
11,250	45,000	.001567	.000034	.....	.....	
11,500	46,000	.001633	.000066	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	Elastic limit.
12,000	48,000	.001667	0.	.....	.....	
12,250	49,000	.005667	.004000	.....	.....	
12,500	50,000	.006500	.000833	.....	.....	
12,750	51,000	.007500	.001000	.....	.....	
13,000	52,000	.008833	.001333	.....	.....	
21,610	86,440	.1433	.134467	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	86,440
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.1967
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.115
Reduction in area after rupture, per cent of original section		36.4
Position of rupture		1".7 from neck
Character of broken surface		granular 55 per cent, silky flaky 45 per cent
Elongation of inch sections		".13, ".33*, ".13

TUBE No. 2.

No. 5573.

Marks, $\frac{12\ M\ R_2\ T}{B\ T_1\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001033	.000333	.....	.....	
8,750	35,000	.001233	.000200	.000033	.000033	
10,000	40,000	.001500	.000267	.000133	.000100	
10,250	41,000	.001533	.000033	.....	.....	Elastic limit.
10,500	42,000	.001633	.000100	.....	.....	
10,750	43,000	.009333	.007700	.....	.....	
22,620	90,480	.1700	.160667	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	90,480
Elastic limit per square inch of original section	do...	41,000
Elongation per inch after rupture	inch..	.2467
Elongation per inch under strain at elastic limit	do...	.001533
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.6 from neck
Character of broken surface		silky, oblique
Elongation of inch sections		″.15, ″.43, ″.16

TUBE NO. 2.

No. 5574.

Marks, $\frac{12\,M\,R_2\,T}{M\,T_1\,O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000367	.000234	.....	.....	
5,000	20,000	.000700	.000333	.....	.....	
7,500	30,000	.001067	.000367	.....	.....	
8,750	35,000	.001267	.000200	.000033	.000033	
10,000	40,000	.001500	.000233	.000100	.000067	Elastic limit.
10,250	41,000	.001600	.000100	.....	.....	
10,500	42,000	.001733	.000133	.....	.....	
10,750	43,000	.006000	.004267	.....	.....	
11,000	44,000	.010333	.004333	.....	.....	
20,290	81,160	.1867	.176367	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	81,160
Elastic limit per square inch of original section	do...	40,000
Elongation per inch after rupture	inch..	.2467
Elongation per inch under strain at elastic limit	do...	.001500
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1″.4 from neck
Character of broken surface		silky
Elongation of inch sections		″.15, ″.31*, ″.28*

TUBE.

No. 5627.

Marks, $\frac{8326\ B}{B\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001367	.000200	.000000	.000000	
10,250	41,000	.001433	.000066	.....	.....	
10,500	42,000	.001467	.000034	.....	.....	
10,750	43,000	.001500	.000033	.....	.....	
11,000	44,000	.001533	.000033	.....	.....	
11,250	45,000	.001567	.000034	.....	.....	
11,500	46,000	.001600	.000033	.....	.....	
11,750	47,000	.001633	.000033	.....	.....	
12,000	48,000	.001667	.000034	.....	.....	
12,250	49,000	.001733	.000066	.....	.....	Elastic limit.
12,500	50,000	.006167	.004434	.....	.....	
12,750	51,000	.007000	.000833	.....	.....	
13,000	52,000	.007667	.000667	.....	.....	
13,250	53,000	.008833	.001166	.....	.....	
13,500	54,000	.009933	.001100	.....	.....	
22,040	88,160	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	88,160
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.2100
Elongation per inch under strain at elastic limit	do..	.001733
Reduction in diameter at point of rupture	do..	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		1″.3 from neck
Character of broken surface		silky
Elongation of inch sections		″.12, ″.36*, ″.15

TUBE.

No. 5646.

Marks, $\frac{12\ M\ R_2\ T}{B\ T_1\ O}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001333	.000166	0.	.....	
10,250	41,000	.001367	.000034	.....	.....	
10,500	42,000	.001400	.000033	.....	.....	
10,750	43,000	.001467	.000067	.....	.....	
11,000	44,000	.001533	.000066	.....	.....	Elastic limit.
11,250	45,000	.005000	.003467	.....	.....	
11,500	46,000	.008000	.003000	.....	.....	
11,750	47,000	.009500	.001500	.....	.....	
12,000	48,000	.011000	.001500	.....	.....	
20,830	83,320	.1500	.1390	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	83,320
Elastic limit per square inch of original section	do...	44,000
Elongation per inch after rupture	inch..	.2033
Elongation per inch under strain at elastic limit	do...	.001533
Reduction in diameter at point of rupture	do..	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		".65 from neck
Character of broken surface		silky, with trace of granulation
Elongation of inch sections		".35", ".15, ".11

TUBE No. 10.

No. 5676.

Marks, $\frac{12\ M\ R_{10}\ T}{M\ T_5\ I}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001067	.000367	.....	.....	
8,750	35,000	.001233	.000166	0.	.....	
10,000	40,000	.001400	.000167	0.	.....	
10,250	41,000	.001467	.000067	.....	.....	
10,500	42,000	.001500	.000033	.....	.....	
10,750	43,000	.001533	.000033	.....	.....	
11,000	44,000	.001567	.000034	.....	.....	
11,250	45,000	.001600	.000033	.....	.....	
11,500	46,000	.001633	.000033	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	
12,000	48,000	.001700	.000033	.....	.....	
12,250	49,000	.001733	.000033	.....	.....	
12,500	50,000	.001767	.000034	.....	.....	Elastic limit.
12,750	51,000	.001867	.000100	.....	.....	
13,000	52,000	.002800	.000933	.....	.....	
13,250	53,000	.004167	.001367	.....	.....	
13,500	54,000	.006667	.002500	.....	.....	
13,750	55,000	.007833	.001166	.....	.....	
22,310	89,240	.1367	.128867	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89,240
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.1367
Elongation per inch under strain at elastic limit	do...	.001767
Reduction in diameter at point of rupture	do...	.015
Reduction in area after rupture, per cent of original section		5.7
Position of rupture		1″.5 from neck
Character of broken surface		granular, band of flaky metal across fractured surface
Elongation of inch sections		″.11, ″.24*, ″.15

TUBE.

No. 5695.

Marks, $\frac{8731\ B}{B\ T,\ M}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001033	.000333	.....	.....	
8,750	35,000	.001233	.000200	.000033	.000033	
10,000	40,000	.001433	.000200	.000033	.000033	
10,250	41,000	.001467	.000034	.....	.....	
10,500	42,000	.001500	.000033	.....	.....	
10,750	43,000	.001533	.000033	.....	.....	
11,000	44,000	.001567	.000034	.....	.....	
11,250	45,000	.001633	.000066	.....	.....	Elastic limit.
11,500	46,000	.002167	.000534	.....	.....	
11,750	47,000	.003667	.001500	.....	.....	
12,000	48,000	.005667	.002000	.....	.....	
12,250	49,000	.006167	.000500	.....	.....	
12,500	50,000	.007333	.001166	.....	.....	
21,680	86,720	.1467	.139367	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	86,720
Elastic limit per square inch of original section	do...	45,000
Elongation per inch after rupture	inch..	.2367
Elongation per inch under strain at elastic limit	do...	.001633
Reduction in diameter at point of rupture	do...	.175
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		1″.40 from neck
Character of broken surface		silky
Elongation of inch sections		″.16, ″.42*, ″.13

TUBE.

No. 5704.

Marks, $\frac{8447\ B_1}{B\ T_2\ M}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001333	.000166	.000033	.000033	
10,250	41,000	.001367	.000034	.....	.....	
10,500	42,000	.001400	.000033	.....	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001500	.000067	.....	.....	
11,250	45,000	.001567	.000067	.....	.....	
11,500	46,000	.001600	.000033	.....	.....	
11,750	47,000	.001633	.000033	.....	.....	Elastic limit.
12,000	48,000	.014000	.012367	.....	.....	
12,250	49,000	.014933	.000933	.....	.....	
12,500	50,000	.016000	.001067	.....	.....	
12,750	51,000	.017000	.001000	.....	.....	
13,000	52,000	.018333	.001333	.....	.....	
19,840	79,360	..1600	.141667	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	79,360
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.2667
Elongation per inch under strain at elastic limit	do...	.001633
Reduction in diameter at point of rupture	do...	.165
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1″.5 from neck
Character of broken surface		silky
Elongation of inch sections		″.15, ″.43*, ″.22

TUBE.

No. 5708.

Marks, $\frac{3731\ B}{M\ T, M}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001200	.000200	0.	.....	
10,000	40,000	.001367	.000167	0.	.....	
10,250	41,000	.001400	.000033	.....	.....	
10,500	42,000	.001433	.000033	.....	.....	
10,750	43,000	.001467	.000034	.....	.....	
11,000	44,000	.001533	.000066	.....	.....	
11,250	45,000	.001567	.000034	.....	.....	
11,500	46,000	.001633	.000066	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	Elastic limit.
12,000	48,000	.002000	.000333	.....	.....	
12,250	49,000	.006000	.006000	.....	.....	
12,500	50,000	.008667	.000667	.....	.....	
12,750	51,000	.009667	.001000	.....	.....	
13,000	52,000	.010500	.000833	.....	.....	
21,410	85,640	.1500	.1395	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	85,640
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.2467
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.165
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1″.4 from neck
Character of broken surface		silky, oblique
Elongation of inch sections		″.10, ″.39, ″.25

JACKET.

No. 5561.

Marks, $\frac{5244\ B}{B\ T.\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000733	.000400	.....	.....	
7,500	30,000	.001100	.000367	.....	.....	
8,750	35,000	.001300	.000200	0.	.....	
10,000	40,000	.001500	.000200	.....	.....	
10,500	42,000	.001567	.000067	0.	.....	
10,750	43,000	.001633	.000066	.....	.....	
11,000	44,000	.001667	.000034	.....	.....	
11,250	45,000	.001733	.000066	.....	.....	Elastic limit.
11,500	46,000	.002067	.000334	.....	.....	
11,750	47,000	.003333	.001266	.....	.....	
12,000	48,000	.005000	.001667	.....	.....	
12,250	49,000	.006000	.001000	.....	.....	
12,500	50,000	.007067	.001067	.....	.....	
22,080	88,320	.1400	.132933	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	88,320
Elastic limit per square inch of original section	do...	45,000
Elongation per inch after rupture	inch..	.2200
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		".75 from neck
Character of broken surface		silky
Elongation of inch sections		".37*, ".16, ".1

JACKET.

No. 5560.

Marks, $\frac{8244\ B_1}{M\ T_4\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001067	.000367	.....	.....	
8,750	35,000	.001233	.000166	0.	.....	
10,000	40,000	.001400	.000167	.....	.....	
10,500	42,000	.001467	.000067	0.	.....	
10,750	43,000	.001500	.000033	.....	.....	
11,000	44,000	.001533	.000033	.....	.....	
11,250	45,000	.001600	.000067	.....	.....	Elastic limit.
11,500	46,000	.002200	.000600	.....	.....	
11,750	47,000	.004600	.002400	.....	.....	
12,000	48,000	.005833	.001233	.....	.....	
12,250	49,000	.006500	.000667	.....	.....	
12,500	50,000	.007667	.001167	.....	.....	
21,610	86,440	.1333	.125633	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	86,440
Elastic limit per square inch of original section	do...	45,000
Elongation per inch after rupture	inch..	.2333
Elongation per inch under strain at elastic limit	do...	.001600
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1″.7 from neck
Character of broken surface		silky
Elongation of inch sections		″.14, ″.41*, ″.15

JACKET.

No. 5572.

Marks, $\overset{8300\ B_L}{B\ T_4\ M}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001200	.000200	0.	.....	
10,000	40,000	.001400	.000200	.....	.....	
10,500	42,000	.001467	.000067	0.	.....	
10,750	43,000	.001533	.000066	.....	.....	
11,000	44,000	.001567	.000034	.....	.....	
11,250	45,000	.001600	.000033	.....	.....	Elastic limit.
11,500	46,000	.003133	.001533	.....	.....	
11,750	47,000	.006000	.002867	.....	.....	
12,000	48,000	.006933	.000933	.....	.....	
12,250	49,000	.007433	.000500	.....	.....	
12,500	50,000	.008333	.000900	.....	.....	
22,030	88,120	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	88,120
Elastic limit per square inch of original section	do...	45,000
Elongation per inch after rupture	inch..	.2333
Elongation per inch under strain at elastic limit	do...	.001600
Reduction in diameter at point of rupture	do...	.155
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1″.48 from neck
Character of broken surface		silky
Elongation of inch sections		″.22, ″.35 *, ″.18

JACKET.

No. 5571.

Marks, $\frac{8300\ B_1}{M\ T_1\ M}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001033	.000366	.....	.....	
8,750	35,000	.001200	.000167	0.	.....	
10,000	40,000	.001400	.000200	.....	.....	
10,500	42,000	.001467	.000067	.000033	.000033	
10,750	43,000	.001533	.000066	.....	.....	
11,000	44,000	.001567	.000034	.....	.....	
11,250	45,000	.001600	.000033	.....	.....	
11,500	46,000	.001633	.000033	.....	.....	
11,750	47,000	.001700	.000067	.....	.....	Elastic limit.
12,000	48,000	.001900	.000200	.....	.....	
12,250	49,000	.002833	.000933	.....	.....	
12,500	50,000	.004500	.001667	.....	.....	
12,750	51,000	.005333	.000833	.....	.....	
13,000	52,000	.006433	.001100	.....	.....	
22,230	88,920	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	88,920
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.1100
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	.do...	.025
Reduction in area after rupture, per cent of original section		8.4
Position of rupture		″.3 from neck
Character of broken surface		granular, flaky streak
Elongation of inch sections		″.10, ″.12, ″.11*

JACKET.

No. 5584.

Marks, $\frac{8368\ B_3}{M\ T_4\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001367	.000200	0.	.....	
10,250	41,000	.001400	.000033	.....	.....	
10,500	42,000	.001467	.000067	.....	.....	
10,750	43,000	.001500	.000033	.....	.....	
11,000	44,000	.001533	.000033	.....	.....	
11,250	45,000	.001567	.000034	.....	.....	
11,500	46,000	.001633	.000066	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	
12,000	48,000	.001700	.000033	.....	.....	
12,250	49,000	.001733	.000033	.....	.....	Elastic limit.
12,500	50,000	.001967	.000234	.....	.....	
12,750	51,000	.004000	.002033	.....	.....	
13,000	52,000	.005667	.001667	.....	.....	
13,250	53,000	.006500	.000833	.....	.....	
13,500	54,000	.007500	.001000	.....	.....	
23,070	92,280	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	92,280
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.1867
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.074
Reduction in area after rupture, per cent of original section	do...	24.6
Position of rupture		″.75 from neck
Character of broken surface		granular, radiating from a flaky dull spot at the circumference
Elongation of inch sections		″.21*, ″.20, ″.15

JACKET.

No. 5585.

Marks, $\frac{8368\ B}{B\ T_4\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001033	.000333	.....	.....	
8,750	35,000	.001200	.000167	0.	.....	
10,000	40,000	.001400	.000200	0.	.....	
10,250	41,000	.001433	.000033	.....	.....	
10,500	42,000	.001500	.000067	.....	.....	
10,750	43,000	.001533	.000033	.....	.....	
11,000	44,000	.001567	.000034	.....	.....	
11,250	45,000	.001600	.000033	.....	.....	
11,500	46,000	.001633	.000033	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	
12,000	48,000	.001700	.000033	.....	.....	
12,250	49,000	.001767	.000067	.....	.....	Elastic limit.
12,500	50,000	.001900	.000133	.....	.....	
12,750	51,000	.002267	.000367	.....	.....	
13,000	52,000	.005000	.002733	.....	.....	
13,250	53,000	.006000	.001000	.....	.....	
13,500	54,000	.007000	.001000	.....	.....	
22,060	91,440	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	91,440
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.2267
Elongation per inch under strain at elastic limit	do...	.001767
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1".8 from neck
Character of broken surface		silky
Elongation of inch sections		".17, ".36*, ".15

JACKET.

No. 5608.

Marks, $\frac{8396\ B}{M\ T, M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001033	.000366	.....	.....	
8,750	35,000	.001200	.000167	0.	.....	
10,000	40,000	.001400	.000200	.....	.....	
10,500	42,000	.001467	.000067	0.	.....	
10,750	43,000	.001533	.000066	.....	.....	
11,000	44,000	.001600	.000067	.....	.....	Elastic limit.
11,250	45,000	.002333	.000733	.....	.....	
11,500	46,000	.006333	.004000	.....	.....	
11,750	47,000	.006733	.000400	.....	.....	
12,000	48,000	.007333	.000600	.....	.....	
12,250	49,000	.008233	.000900	.....	.....	
21,840	87,360	.1667	.158467	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	87,360
Elastic limit per square inch of original section	do...	44,000
Elongation per inch after rupture	inch..	.2333
Elongation per inch under strain at elastic limit	do....	.001600
Reduction in diameter at point of rupture	do....	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1".5 from neck
Character of broken surface		silky
Elongation of inch sections		".20, ".36*, ".14

JACKET.

No. 5628.

Marks, $\frac{8721\ B_2}{B\ T_4\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001033	.000366	.....	.....	
8,750	35,000	.001200	.000167	0.	.....	
10,000	40,000	.001367	.000167	.....	.....	
10,500	42,000	.001467	.000100	.000033	.000033	
10,750	43,000	.001533	.000066	.....	.....	
11,000	44,000	.001567	.000034	.....	.....	
11,250	45,000	.001600	.000033	.....	.....	
11,500	46,000	.001633	.000033	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	
12,000	48,000	.001733	.000066	.....	.....	Elastic limit.
12,250	49,000	.001867	.000134	.....	.....	
12,500	50,000	.004333	.002466	.....	.....	
12,750	51,000	.005833	.001500	.....	.....	
13,000	52,000	.006600	.000767	.....	.....	
13,250	53,000	.007100	.000500	.....	.....	
22,810	91,240	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	91,240
Elastic limit per square inch of original section	do...	48,000
Elongation per inch after rupture	inch..	.1900
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		".83 from neck
Character of broken surface		silky
Elongation of inch sections		".10, ".12, ".35*

JACKET.

No. 5660.

Marks, $\frac{8721\ B}{M\ T,\ M}$
Diameter, ".565.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001200	.000200	0.	.....	
10,000	40,000	.001367	.000167	.....	.....	
10,500	42,000	.001433	.000066	0.	.....	
10,750	43,000	.001500	.000067	.....	.....	
11,000	44,000	.001533	.000033	.....	.....	
11,250	45,000	.001534	.000001	.....	.....	
11,500	46,000	.001567	.000033	.....	.....	
11,750	47,000	.001633	.000066	.....	.....	
12,000	48,000	.001667	.000034	.....	.....	
12,250	49,000	.001700	.000033	.....	.....	
12,500	50,000	.001733	.000033	.....	.....	
12,750	51,000	.001767	.000034	.....	.....	Elastic limit.
13,000	52,000	.002333	.000566	.....	.....	
13,250	53,000	.004833	.002500	.....	.....	
13,500	54,000	.006167	.001334	.....	.....	
13,750	55,000	.006667	.000500	.....	.....	
14,000	56,000	.007833	.001166	.....	.....	
23,490	93,960	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	93,960
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.2133
Elongation per inch under strain at elastic limit	do...	.001767
Reduction in diameter at point of rupture	do...	.165
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		".13, ".37*, ".14

JACKET.

No. 5675.

Marks, $\frac{12\ M\ R_2\ J}{M\ T_1\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000600	.000300	.....	.....	
7,500	30,000	.000967	.000367	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001467	.000067	.....	.....	
11,250	45,000	.001500	.000033	.....	.....	
11,500	46,000	.001533	.000033	.....	.....	
11,750	47,000	.001567	.000034	.....	.....	
12,000	48,000	.001600	.000033	.....	.....	
12,250	49,000	.001633	.000033	.....	.....	
12,500	50,000	.001667	.000034	.....	.....	
12,750	51,000	.001700	.000033	.....	.....	
13,000	52,000	.001733	.000033	.....	.....	
13,250	53,000	.001767	.000034	.....	.....	
13,500	54,000	.001800	.000033	.....	.....	
13,750	55,000	.001833	.000033	.....	.....	
14,000	56,000	.001867	.000034	.....	.....	
14,250	57,000	.001900	.000033	.....	.....	
14,500	58,000	.001967	.000067	.....	.....	
14,750	59,000	.002000	.000033	.....	.....	Elastic limit.
15,000	60,000	.002133	.000133	.....	.....	
15,250	61,000	.002300	.000167	.....	.....	
15,500	62,000	.003000	.000700	.....	.....	
15,750	63,000	.004167	.001167	.....	.....	
16,000	64,000	.006667	.002500	.....	.....	
23,220	92,880	.1233	.116633	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	92,880
Elastic limit per square inch of original section	do...	59,000
Elongation per inch after rupture	inch..	.2167
Elongation per inch under strain at elastic limit	do...	.002000
Reduction in diameter at point of rupture	do...	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		1″.4 from neck
Character of broken surface		silky
Elongation of inch sections		″.19, ″.35*, ″.11

JACKET.

No. 5696.

Marks, $\frac{8684\ B}{B\ T,\ M}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000833	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001033	.000366	.....	.....	
8,750	35,000	.001200	.000167	0.	.....	
10,000	40,000	.001400	.000200	.....	.....	
10,500	42,000	.001467	.000067	.000033	.000033	
10,750	43,000	.001500	.000033	.....	.....	
11,000	44,000	.001533	.000033	.....	.....	
11,250	45,000	.001567	.000034	.....	.....	
11,500	46,000	.001600	.000033	.....	.....	
11,750	47,000	.001633	.000033	.....	.....	
12,000	48,000	.001700	.000067	.....	.....	Elastic limit.
12,250	49,000	.003667	.001967	.....	.....	
12,500	50,000	.005167	.001500	.....	.....	
12,750	51,000	.005833	.000666	.....	.....	
13,000	52,000	.007333	.001500	.....	.....	
13,250	53,000	.008167	.000834	.....	.....	
22,490	89,960	.1200	.111833	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89,960
Elastic limit per square inch of original section	do...	48,000
Elongation per inch after rupture	inch..	.2000
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.165
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		″.13, ″.38*, ″.69

JACKET.

No. 5705.

Marks, $\frac{8940\ B_1}{M\ T_2\ M}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000367	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001333	.000166	.....	.....	
10,500	42,000	.001400	.000067	0.	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001500	.000067	.....	.....	
11,250	45,000	.001533	.000033	.....	.....	
11,500	46,000	.001600	.000067	.....	.....	
11,750	47,000	.001633	.000033	.....	.....	
12,000	48,000	.001667	.000034	.....	.....	
12,250	49,000	.001700	.000033	.....	.....	
12,500	50,000	.001733	.000033	.....	.....	Elastic limit.
12,750	51,000	.003000	.001267	.....	.....	
13,000	52,000	.004000	.001000	.....	.....	
13,250	53,000	.008000	.004000	.....	.....	
13,500	54,000	.009067	.001067	.....	.....	
13,750	55,000	.009667	.000600	.....	.....	
22,790	91,160	.1400	.130333	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	91,160
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.2167
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.165
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1″.3 from neck
Character of broken surface		silky
Elongation of inch sections		″.17, ″.36*, ″.12

JACKET.

No. 5716.

Marks, $\frac{12\ M\ R_{12}\ J}{B\ T,\ O}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000267	.000200	.....	.....	
5,000	20,000	.000633	.000366	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001100	.000133	0.	.....	
10,000	40,000	.001300	.000200	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
12,500	50,000	.001600	.000233	.....	.....	
12,750	51,000	.001633	.000033	.....	.....	
13,000	52,000	.001667	.000034	.....	.....	
13,250	53,000	.001700	.000033	.....	.....	
13,500	54,000	.001733	.000033	.....	.....	
13,750	55,000	.001800	.000067	.....	.....	Elastic limit.
14,000	56,000	.003667	.001867	.....	.....	
14,250	57,000	.005333	.001666	.....	.....	
14,500	58,000	.006667	.001334	.....	.....	
14,750	59,000	.008167	.001500	.....	.....	
15,000	60,000	.009333	.001166	.....	.....	
23,120	92,480	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	92,480
Elastic limit per square inch of original section	do...	55,000
Elongation per inch after rupture	inch..	.2133
Elongation per inch under strain at elastic limit	do...	.001800
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		at middle of stem
Character of broken surface		silky
Elongations of inch sections		".13, ".38, ".13

JACKET.

No. 5715.

Marks, $\frac{12\,M\,R\,14\,J}{B\,T,\,O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001333	.000166	.....	.....	
10,500	42,000	.001400	.000067	0.	.....	
12,500	50,000	.001733	.000333	.....	.....	
12,750	51,000	.001767	.000034	.....	.....	
13,000	52,000	.001833	.000066	.....	.....	
13,250	53,000	.001867	.000034	.....	.....	
13,500	54,000	.001933	.000066	.....	.....	
13,750	55,000	.001967	.000034	.....	.....	
14,000	56,000	.002000	.000033	.....	.....	
14,250	57,000	.002033	.000033	.....	.....	Elastic limit.
14,500	58,000	.002333	.000300	.....	.....	
14,750	59,000	.006667	.004334	.....	.....	
15,000	60,000	.007833	.001166	.....	.....	
15,250	61,000	.008833	.001000	.....	.....	
15,500	62,000	.010000	.001167	.....	.....	
23,180	92,720	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	92,720
Elastic limit per square inch of original section	do...	57,000
Elongation per inch after rupture	inch..	.2223
Elongation per inch under strain at elastic limit	do...	.002033
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1″.3 from neck
Character of broken surface		fine silky
Elongation of inch sections		″.11, ″.34*, ″.22

JACKET.

No. 5718.

Marks, $\frac{3526\ B}{B\ T_{10}\ M}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000933	.000300	.....	.....	
8,750	35,000	.001100	.000167	0.	.....	
10,000	40,000	.001267	.000167	.....	.....	
10,500	42,000	.001333	.000066	0.	.....	
10,750	43,000	.001367	.000034	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001467	.000034	.....	.....	
11,750	47,000	.001467	0.	.....	.....	
12,000	48,000	.001500	.000033	.....	.....	
12,250	49,000	.001567	.000067	.....	.....	Elastic limit.
12,500	50,000	.001700	.000133	.....	.....	
		.002667	.000967	.....	.....	
12,750	51,000	.004500	.001833	.....	.....	
13,000	52,000	.005267	.000767	.....	.....	
13,250	53,000	.006267	.001000	.....	.....	
13,500	54,000	.007333	.001066	.....	.....	
22,790	91,160	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	91,160
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.1833
Elongation per inch under strain at elastic limit	do...	.001567
Reduction in diameter at point of rupture	do...	.135
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		1″.56 from neck
Character of broken surface		silky
Elongation of inch sections		″.12, ″.33*, ″.10

TABULATION OF TENSION SPECIMENS FROM 12-INCH B. L. RIFLED MORTARS (STEMS 3" LONG, ".564 DIAMETER).

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.	Remarks.
			Pounds.	*Pounds.*	*Pr. ct.*	*Pr. ct.*		
5557	Tube	Middle	46,000	85,720	24.3	47.2	Silky, minute cracks developed in surface of stem.	Breech end.
5556	do	do	48,000	88,840	24	47.2	Silky	Muzzle end.
5559	do	do	48,000	90,760	20.7	49.7	do	Breech end.
5558	do	do	49,000	89,640	20	47.2	Silky, oblique	Muzzle end.
5570	do	do	44,000	85,760	22.7	47.2	Silky	Breech end.
5569	do	do	47,000	86,440	19.7	36.4	Granular 55 per cent, silky flaky 45 per cent.	Muzzle end.
5573	Tube No. 2	Outside	41,000	90,480	24.7	44.6	Silky, oblique	Breech end.
5574	do	do	40,000	81,160	24.7	47.2	Silky	Muzzle end.
5627	Tube	Middle	49,000	88,160	21	52.2	do	Breech end.
5646	Tube No. 9	Outside	44,000	83,320	20.3	44.6	Silky, with trace of granulation.	Do.
5676	Tube No. 10	Inside	50,000	89,240	16.7	5.7	Granular, band of flaky metal across fractured surface.	Muzzle end.
5695	Tube	Middle	45,000	86,720	23.7	52.2	Silky	Breech end.
5704	do	do	47,000	79,360	26.7	49.7	do	Do.
5708	do	do	47,000	85,610	24.7	49.7	Silky, oblique	Muzzle end.
5561	Jacket	do	45,000	88,320	22	49.7	Silky	Breech end.
5560	do	do	45,000	86,440	23.3	49.7	do	Muzzle end.
5572	do	do	45,000	88,120	23.3	47.2	do	Breech end.
5571	do	do	47,000	88,920	11	8.4	Granular, flaky streak.	Muzzle end.
5584	do	do	49,000	92,280	18.7	24.6	Granular, radiating from a flaky dull spot at circumference.	Do.
5585	do	do	49,000	91,440	22.7	44.6	Silky	Breech end.
5608	do	do	44,000	87,360	23.3	47.2	do	Muzzle end.
5628	do	do	48,000	91,240	19	44.6	do	Breech end.
5660	do	do	51,000	93,960	21.3	49.7	do	Muzzle end.
5675	do	Outside	59,000	92,880	21.7	37.1	do	Do.
5696	do	Middle	48,000	89,960	20	49.7	do	Breech end.
5705	do	do	50,000	91,160	21.7	49.7	do	Muzzle end.
5716	do	Outside	55,000	92,480	21.3	44.6	do	Breech end.
5715	do	do	57,000	92,720	22.3	49.7	Fine, silky	Do.
5718	do	Middle	49,000	91,160	18.3	41.9	Silky	Do.

RIFLE-BARREL STEEL, .30-CALIBER.

RIFLE-BARREL STEEL, .30 CALIBER

STOCK FOR BARRELS.

No. 5537.

Marks, 49.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000333	.000233	.....	.....	
4,000	20,000	.000667	.000334	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001333	.000333	0.	.....	
10,000	50,000	.001700	.000367	.....	.....	
12,000	60,000	.002067	.000367	0.	.....	
13,400	67,000	.002333	.000266	.....	.....	Elastic limit.
13,600	68,000	.006233	.003900	.....	.....	
13,800	69,000	.006667	.000434	.....	.....	
14,000	70,000	.007300	.000633	.....	.....	
14,200	71,000	.008133	.000833	.....	.....	
14,400	72,000	.008767	.000634	.....	.....	
14,600	73,000	.009167	.000400	.....	.....	
14,800	74,000	.010133	.000966	.....	.....	
15,600	78,000	.0133	.003167	.....	.....	
16,400	82,000	.0167	.0034	.....	.....	
17,200	86,000	.0200	.0033	.....	.....	
18,000	90,000	.0233	.0033	.....	.....	
18,800	94,000	.0267	.0034	.....	.....	
19,600	98,000	.0300	.0033	.....	.....	
20,400	102,000	.0333	.0333	.....	.....	
21,200	106,000	.0400	.0067	.....	.....	
22,000	110,000	.0467	.0067	.....	.....	
22,800	114,000	.0567	.0100	.....	.....	
23,600	118,000	.0733	.0166	.....	.....	
24,120	120,600	.1200	.0467	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	120,600
Elastic limit per square inch of original section	do...	67,000
Elongation per inch after rupture	inch..	.1700
Elongation per inch under strain at elastic limit	do...	.002333
Reduction in diameter at point of rupture	do...	.115
Reduction in area after rupture, per cent of original section		40.3
Position of rupture		1".4 from neck
Character of broken surface		fine silky; trace of granulation
Elongation of inch sections		".10, ".26", ".15

FROM FORGED BARREL.

No. 5538.

Marks, 49 A.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000367	.000234	.....	.....	
4,000	20,000	.000733	.000366	.....	.....	
6,000	30,000	.001100	.000367	.....	.....	
8,000	40,000	.001467	.000367	.....	.....	
10,000	50,000	.001800	.000333	.000033	.000033	
11,000	55,000	.001933	.000133	.....	.....	
11,400	57,000	.002000	.000067	.....	.....	Elastic limit.
						Load fell.
10,800	54,000	.008000	.006000	.....	.....	
11,000	55,000	.009167	.001167	.....	.....	
11,200	56,000	.009667	.000500	.....	.....	
11,600	58,000	.0100	.000333	.....	.....	
12,000	60,000	.0133	.0033	.....	.....	
12,800	64,000	.0167	.0034	.....	.....	
13,600	68,000	.0200	.0033	.....	.....	
14,400	72,000	.0233	.0033	.....	.....	
15,200	76,000	.0300	.0067	.....	.....	
16,000	80,000	.0333	.0033	.....	.....	
16,800	84,000	.0400	.0067	.....	.....	
17,600	88,000	.0500	.0100	.....	.....	
18,400	92,000	.0600	.0100	.....	.....	
19,200	96,000	.0800	.0200	.....	.....	
19,720	98,600	.1333	.0533	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	98,600
Elastic limit per square inch of original section	do...	57,000
Elongation per inch after rupture	inch..	.1867
Elongation per inch under strain at elastic limit	do...	.002000
Reduction in diameter at point of rupture	do...	.085
Reduction in area after rupture, per cent of original section		30.7
Position of rupture		1".4 from neck
Character of broken surface		fine silky, 40 per cent; granular, 60 per cent
Elongation of inch sections		".14, ".24 *, ".18

SAMPLES FROM ROLLED BARREL, REGULAR STOCK IN USE.

BREECH END.

No. 5580.

Marks, No. 49.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000367	.000234	.....	.....	
5,000	20,000	.000700	.000333	.....	.....	
7,500	30,000	.001067	.000367	.....	.....	
10,000	40,000	.001433	.000366	0.	.....	
12,500	50,000	.001800	.000367	.....	.....	
14,500	58,000	.002033	.000233	.....	.....	
14,750	59,000	.002100	.000067	.....	.....	Elastic limit.
15,000	60,000	.003167	.001067	.....	.....	
		.008500	.005333	.....	.....	
15,500	62,000	.0100	.0015	.....	.....	
16,000	64,000	.0133	.0033	.....	.....	
17,000	68,000	.0167	.0034	.....	.....	
18,000	72,000	.0200	.0033	.....	.....	
19,000	76,000	.0233	.0033	.....	.....	
20,000	80,000	.0267	.0034	.....	.....	
21,000	84,000	.0300	.0033	.....	.....	
22,000	88,000	.0333	.0033	.....	.....	
23,000	92,000	.0400	.0067	.....	.....	
24,000	96,000	.0467	.0067	.....	.....	
25,000	100,000	.0600	.0133	.....	.....	
26,000	104,000	.0800	.0200	.....	.....	
26,670	106,680	.1233	.0433	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	106,680
Elastic limit per square inch of original section	do...	59,000
Elongation per inch after rupture	inch..	.1600
Elongation per inch under strain at elastic limit	do...	.002100
Reduction in diameter at point of rupture	do...	.064
Reduction in area after rupture, per cent of original section		27.6
Position of rupture		".9 from neck
Character of broken service		fine granular, raidiating from a spot near the center
Elongation of inch sections		".21*, ".16, ".11

MUZZLE END.

No. 5581.

Marks, No. 49.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000333	.000200	.....	.....	
4,000	20,000	.000667	.000334	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001367	.000367	.....	.....	
10,000	50,000	.001700	.000333	0.	.....	
11,000	55,000	.001900	.000200	.....	.....	
12,000	60,000	.002067	.000167	0.	.....	
12,200	61,000	.002100	.000033	.....	.....	
12,400	62,000	.002133	.000033	.....	.....	Elastic limit. Load fall.
11,800	59,000	.003833	.001700	.....	.....	
12,000	60,000	.006000	.002167	.....	.....	
12,200	61,000	.008333	.002333	.....	.....	
12,400	62,000	.009333	.001000	.....	.....	
13,200	66,000	.0133	.003967	.....	.....	
14,000	70,000	.0167	.0034	.....	.....	
14,800	74,000	.0200	.0033	.....	.....	
15,600	78,000	.0233	.0033	.....	.....	
16,400	82,000	.0267	.0034	.....	.....	
17,200	86,000	.0333	.0066	.....	.....	
18,000	90,000	.0367	.0034	.....	.....	
18,800	94,000	.0467	.0100	.....	.....	
19,600	98,000	.0533	.0066	.....	.....	
20,400	102,000	.0667	.0134	.....	.....	
21,200	106,000	.0933	.0266	.....	.....	
21,410	107,050	.1200	.0267	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	107,050
Elastic limit per square inch of original section	do...	62,000
Elongation per inch after rupture	inch..	.1667
Elongation per inch under strain at elastic limit	do...	.002133
Reduction in diameter at point of rupture	do...	.095
Reduction in area after rupture, per cent of original section	do...	34.0
Position of rupture		1" from neck
Character of broken surface		silky, interspersed with fine granulation
Elongation of inch sections		".25", ".15, ".10

TWO SAMPLES FROM A BARREL THAT HAD BEEN ROLLED, COOLED IN AIR, REHEATED IN COAL FURNACE, AND ANNEALED IN CHARCOAL.

FROM MUZZLE END.

No. 5547.

Marks, 49–A–M.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3′.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000300	.000200	.....	.....	
4,000	20,000	.000633	.000333	.....	.....	
6,000	30,000	.001000	.000367	.....	.....	
8,000	40,000	.001333	.000333	0.	.....	
10,000	50,000	.001667	.000334	.....	.....	
11,000	55,000	.001833	.000166	.....	.....	
11,600	58,000	.001967	.000134	.....	.....	Elastic limit.
12,000	60,000	.002133	.000166	.....	.....	
						Load fell.
11,200	56,000	.003500	.001367	.....	.....	
11,400	57,000	.004333	.000833	.....	.....	
11,600	58,000	.006167	.001834	.....	.....	
11,800	59,000	.007167	.001000	.....	.....	
12,000	60,000	.008033	.000866	.....	.....	
12,400	62,000	.009200	.001167	.....	.....	
13,200	66,000	.0133	.0041	.....	.....	
14,000	70,000	.0167	.0034	.....	.....	
14,800	74,000	.0200	.0033	.....	.....	
15,600	78,000	.0233	.0033	.....	.....	
16,400	82,000	.0267	.0034	.....	.....	
17,200	86,000	.0300	.0033	.....	.....	
18,000	90,000	.0367	.0067	.....	.....	
18,800	94,000	.0433	.0066	.....	.....	
19,600	98,000	.0500	.0067	.....	.....	
20,400	102,000	.0633	.0133	.....	.....	
21,200	106,000	.0833	.0200	.....	.....	
21,510	107,550	.1267	.0434	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	107,550
Elastic limit per square inch of original section	do...	58,000
Elongation per inch after rupture	inch..	.1867
Elongation per inch under strain at elastic limit	do...	.001967
Reduction in diameter at point of rupture	do...	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		1″.23 from neck
Character of broken surface		silky, with trace of granulation
Elongation of inch sections		″.13,″.21*,″.22

From Breech End of same Barrel as No. 5547.

No. 5548.

Marks, 49–A B.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.		0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	0.	.....	
4,000	20,000	.000667	.000367	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001333	.000333	.....	.....	
10,200	51,000	.001700	.000367	.....	.....	
11,000	55,000	.001900	.000200	0.	.....	
11,200	56,000	.001967	.000067	.....	.....	
11,400	57,000	.002000	.000033	.....	.....	Elastic limit.
11,600	58,000	.002133	.000133	.....	.....	
						Load fell.
11,000	55,000	.003033	.000900	.....	.....	
11,200	56,000	.003567	.000534	.....	.....	
11,400	57,000	.007000	.003433	.....	.....	
11,600	58,000	.007600	.000600	.....	.....	
11,800	59,000	.008033	.000433	.....	.....	
12,000	60,000	.008600	.000567	.....	.....	
12,400	62,000	.009833	.001233	.....	.....	
13,200	66,000	.0133	.003467	.....	.....	
14,000	70,000	.0167	.0034	.....	.....	
14,800	74,000	.0200	.0033	.....	.....	
15,600	78,000	.0233	.0033	.....	.....	
16,400	82,000	.0267	.0034	.....	.....	
17,200	86,000	.0333	.0066	.....	.....	
18,000	90,000	.0367	.0034	.....	.....	
18,800	94,000	.0433	.0066	.....	.....	
19,600	98,000	.0533	.0100	.....	.....	
20,400	102,000	.0667	.0134	.....	.....	
21,200	106,000	.0967	.0300	.....	.....	
21,270	106,350	.1167	.0200	.....	.....	Tensile strength.

General summary.

Tensile strenth per square inch of original section	pounds..	106,350
Elastic limit per square inch of original section	do...	57,000
Elongation per inch after rupture	inch..	.1767
Elongation per inch under strain at elastic limit	do...	.002000
Reduction in diameter at point of rupture	do...	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		″.98 from neck
Character of broken surface		silky, with trace of granulation
Elongation of inch sections		″.27*, ″.16, ″.10

BAR, 1″.05 DIAMETER.

No. 5539.

Marks, 60.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000300	.000200	.....	.....	
4,000	20,000	.000633	.000333	.....	.....	
6,000	30,000	.000967	.000334	.....	.....	
8,000	40,000	.001300	.000333	.....	.....	
10,000	50,000	.001633	.000333	0.	.....	
12,000	60,000	.001967	.000334	.....	.....	
14,000	70,000	.002333	.000366	0.	.....	
15,000	75,000	.002533	.000200	.....	.....	
15,200	76,000	.002567	.000034	.....	.....	
15,400	77,000	.002633	.000066	.....	.....	Elastic limit. Load fell.
14,800	74,000	.005000	.002367	.....	.....	
15,000	75,000	.009500	.004500	.....	.....	
15,200	76,000	.010333	.000833	.....	.....	
16,000	80,000	.0133	.002967	.....	.....	
16,800	84,000	.0167	.0034	.....	.....	
17,600	88,000	.0200	.0033	.....	.....	
18,400	92,000	.0233	.0033	.....	.....	
19,200	96,000	.0267	.0034	.....	.....	
20,000	100,000	.0300	.0033	.....	.....	
20,800	104,000	.0367	.0067	.....	.....	
21,600	108,000	.0400	.0033	.....	.....	
22,400	112,000	.0500	.0100	.....	.....	
23,200	116,000	.0567	.0067	.....	.....	
24,000	120,000	.0800	.0233	.....	.....	
24,390	121,950	.1300	.0500	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	121,950
Elastic limit per square inch of original section	do...	77,000
Elongation per inch after rupture	inch..	.1667
Elongation per inch under strain at elastic limit	do...	.002633
Reduction in diameter at point of rupture	do...	.125
Reduction in area after rupture, per cent of original section		43.3
Position of rupture		1″.47 from neck
Character of broken surface		very fine, silky
Elongation of inch sections		″.11, ″.28*, ″.11

NEW STOCK.

No. 5540.

Marks, 61.
Diameter, ".505
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000333	.000200	.....	.....	
4,000	20,000	.000667	.000334	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001367	.000367	.....	.....	
10,000	50,000	.001733	.000366	0.	.....	
12,000	60,000	.002133	.000400	.....	.....	
13,000	65,000	.002333	.000200	.....	.....	
14,000	70,000	.002500	.000167	.000067	.000067	
14,600	73,000	.002600	.000100	.....	.....	Elastic limit.
14,800	74,000	.002767	.000167	.....	.....	
						Load fell.
14,000	70,000	.004833	.002066	.....	.....	
		.010000	.005167	.....	.....	
14,400	72,000	.0167	.0067	.....	.....	
15,200	76,000	.0233	.0066	.....	.....	
16,000	80,000	.0267	.0034	.....	.....	
16,800	84,000	.0300	.0033	.....	.....	
17,600	88,000	.0367	.0067	.....	.....	
18,400	92,000	.0433	.0066	.....	.....	
19,200	96,000	.0533	.0100	.....	.....	
20,000	100,000	.0633	.0100	.....	.....	
20,800	104,000	.0867	.0234	.....	.....	
21,360	106,800	.1433	.0566	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	106,800
Elastic limit per square inch of original section	do...	73,000
Elongation per inch after rupture	inch..	".2367
Elongation per inch under strain at elastic limit	do...	.002600
Reduction in diameter at point of rupture	do...	".145
Reduction in area after rupture, per cent of original section		49.1
Position of rupture		at middle of stem
Character of broken surface		very fine, silky
Elongation of inch sections		".16, ".40", ".15

From Forged Barrel of New Stock.

No. 5541.

Marks, 61 A.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3′.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000333	.000200	.....	.....	
4,000	20,000	.000667	.000334	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001367	.000367	.....	.....	
10,000	50,000	.001700	.000333	0.	.....	
12,000	60,000	.002033	.000333	0.	.....	Elastic limit.
12,200	61,000	.003333	.001300	.....	.....	
						Load fell.
11,200	56,000	.004267	.000934	.....	.....	
11,400	57,000	.004667	.000400	.....	.....	
11,600	58,000	.005000	.000333	.....	.....	
11,800	59,000	.006333	.001333	.....	.....	
12,000	60,000	.010000	.000667	.....	.....	
12,800	64,000	.0133	.0033	.....	.....	
13,600	68,000	.0200	.0067	.....	.....	
14,400	72,000	.0233	.0033	.....	.....	
15,200	76,000	.0267	.0034	.....	.....	
16,000	80,000	.0300	.0033	.....	.....	
16,800	84,000	.0367	.0067	.....	.....	
17,600	88,000	.0433	.0066	.....	.....	
18,400	92,000	.0533	.0100	.....	.....	
19,200	96,000	.0633	.0100	.....	.....	
20,000	100,000	.0867	.0234	.....	.....	
20,510	102,550	.1400	.0533	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	102,550
Elastic limit per square inch of original section	do...	60,000
Elongation per inch after rupture	inch..	.2133
Elongation per inch under strain at elastic limit	do...	.002033
Reduction in diameter at point of rupture	do...	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		1″.6 from neck
Character of broken surface		silky, interspersed with fine granulation
Elongation of inch sections		″.14, ″.32*, ″.18

NEW SAMPLE, BAR 1″.4 DIAMETER.

No. 5542.

Marks, 62.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000333	.000200	.....	.....	
4,000	20,000	.000700	.000367	.....	.....	
6,000	30,000	.001033	.000333	.....	.....	
8,000	40,000	.001367	.000334	.....	.....	
10,000	50,000	.001733	.000366	.000033	.000033	
12,000	60,000	.002100	.000367	.000033	0.	
14,000	70,000	.002500	.000400	.000033	0.	
15,000	75,000	.002700	.000200	.....	.....	
15,600	78,000	.002867	.000167	.....	.....	
15,800	79,000	.002933	.000066	.....	.....	Elastic limit.
16,000	80,000	.003067	.000134	.000300	.000267	
16,200	81,000	.003333	.000266	.....	.....	
16,400	82,000	.004267	.000934	.....	.....	
16,600	83,000	.004900	.000633	.....	.....	
16,800	84,000	.006100	.001200	.....	.....	
17,000	85,000	.006667	.000567	.....	.....	
17,200	86,000	.007033	.000366	.....	.....	
17,400	87,000	.007467	.000434	.....	.....	
17,600	88,000	.008067	.000600	.....	.....	
17,800	89,000	.008833	.000766	.....	.....	
18,000	90,000	.009500	.000667	.....	.....	
19,200	96,000	.0133	.0038	.....	.....	
20,000	100,000	.0167	.0034	.....	.....	
20,800	104,000	.0200	.0033	.....	.....	
21,600	108,000	.0233	.0033	.....	.....	
22,400	112,000	.0267	.0034	.....	.....	
23,200	116,000	.0300	.0033	.....	.....	
24,000	120,000	.0333	.0033	.....	.....	
24,800	124,000	.0367	.0034	.....	.....	
25,600	128,000	.0433	.0066	.....	.....	
26,400	132,000	.0500	.0067	.....	.....	
27,200	136,000	.0667	.0167	.....	.....	
27,980	139,900	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	139,900
Elastic limit per square inch of original section	do...	79,000
Elongation per inch after rupture	inch..	.1533
Elongation per inch under strain at elastic limit	do...	.002933
Reduction in diameter at point of rupture	do...	.105
Reduction in area after rupture, per cent of original section	do...	37.1
Position of rupture		1″.5 from neck
Character of broken surface		very fine silky, cup-shaped ends
Elongation of inch sections		″.10, ″.26, ″.10

NEW SAMPLE, BAR 1".15 DIAMETER.

No. 5543.

Marks, 63.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	.....	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000633	.000333	.....	.....	
6,000	30,000	.000967	.000334	.....	.....	
8,000	40,000	.001333	.000366	.....	.....	
10,000	50,000	.001667	.000334	0.	.....	
12,000	60,000	.002000	.000333	.....	.....	
14,000	70,000	.002400	.000400	0.	.....	
14,200	71,000	.002433	.000033	.....	.....	Elastic limit.
14,400	72,000	.003000	.000567	.....	.....	Load fell.
14,000	70,000	.005333	.002333	.....	.....	
14,200	71,000	.008367	.003034	.....	.....	
14,400	72,000	.009033	.000666	.....	.....	
14,600	73,000	.009633	.000600	.....	.....	
14,800	74,000	.010067	.000434	.....	.....	
16,000	80,000	.0133	.003233	.....	.....	
16,800	84,000	.0167	.0034	.....	.....	
17,600	88,000	.0200	.0033	.....	.....	
18,400	92,000	.0233	.0033	.....	.....	
19,200	96,000	.0267	.0034	.....	.....	
20,000	100,000	.0300	.0033	.....	.....	
20,800	104,000	.0367	.0067	.....	.....	
21,600	108,000	.0400	.0033	.....	.....	
22,400	112,000	.0467	.0067	.....	.....	
23,000	116,000	.0567	.0100	.....	.....	
24,000	120,000	.0767	.0200	.....	.....	
24,410	122,050	.1100	.0333	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	122,050
Elastic limit per square inch of original section	do...	71,000
Elongation per inch after rupture	inch..	.1733
Elongation per inch under strain at elastic limit	do...	.002433
Reduction in diameter at point of rupture	do...	.115
Reduction in area after rupture, per cent of original section		40.3
Position of rupture		1".5 from neck
Character of broken surface		fine silky; trace of granulation; cup-shaped ends
Elongation of inch sections		",10, ",29*, ",13

NEW SAMPLE, BAR 1.″15 DIAMETER.

No. 5544.

Marks, 64.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000333	.000200	.....	.....	
4,000	20,000	.000700	.000367	.....	.....	
6,000	30,000	.001000	.000300	.....	.....	
8,000	40,000	.001367	.000367	.....	.....	
10,000	50,000	.001733	.000366	.000033	.000033	
12,000	60,000	.002100	.000367	.....	.....	
14,000	70,000	.002467	.000367	.000067	.000034	
14,200	71,000	.002533	.000066	.....	.....	
14,400	72,000	.002567	.000034	.....	.....	
14,600	73,000	.002600	.000033	.....	.....	
14,800	74,000	.002633	.000033	.....	.....	
15,000	75,000	.002667	.000034	.....	.....	
15,200	76,000	.002700	.000033	.....	.....	
15,400	77,000	.002733	.000033	.....	.....	
15,600	78,000	.002800	.000067	.....	.....	
15,800	79,000	.002833	.000033	.....	.....	
16,000	80,000	.002900	.000067	.....	.....	
16,200	81,000	.002967	.000067	.....	.....	
16,400	82,000	.003033	.000066	.....	.....	
16,600	83,000	.003100	.000067	.....	.....	Elastic limit.
16,800	84,000	.003300 .005667	.000200 .002367	.....	.....	
17,000	85,000	.006833	.001166	.....	.....	
17,200	86,000	.007900	.001067	.....	.....	
17,400	87,000	.008667	.000767	.....	.....	
17,600	88,000	.009133	.000466	.....	.....	
18,400	92,000	.0133	.004167	.....	.....	
19,200	96,000	.0167	.0034	.....	.....	
20,000	100,000	.0200	.0033	.....	.....	
20,800	104,000	.0200+	.0000+	.....	.....	
21,600	108,000	.0233	.0033	.....	.....	
22,400	112,000	.0267	.0034	.....	.....	
23,200	116,000	.0300	.0033	.....	.....	
24,000	120,000	.0367	.0067	.....	.....	
24,800	124,000	.0400	.0033	.....	.....	
25,600	128,000	.0467	.0067	.....	.....	
26,400	132,000	.0600	.0133	.....	.....	
27,200	136,000	.0767	.0167	.....	.....	
27,510	137,550	.1000	.0233	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	137,550
Elastic limit per square inch of original section	do...	83,000
Elongation per inch after rupture	inch..	.1400
Elongation per inch under strain at elastic limit	do...	.003100
Reduction in diameter at point of rupture	do...	.095
Reduction in area after rupture, per cent of original section		34.0
Position of rupture		1″.08 from neck
Character of broken surface		fine silky, interspersed with fine granulation; cup-shaped ends
Elongation of inch sections		″.08, ″.12, ″.22 *

SANDERSON'S TOOL STEEL FOR HEAVY BARREL, .30 CALIBER.

No. 5553.

Mark, S.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
10,000	40,000	.001367	.000367	0.	.....	
12,000	48,000	.001633	.000266	.....	.....	
12,250	49,000	.001667	.000034	.....	.....	Elastic limit.
12,500	50,000	.003333	.001666	.....	.....	
12,750	51,000	.004200	.000867	.....	.....	
13,000	52,000	.004667	.000467	.....	.....	
13,250	53,000	.005333	.000666	.....	.....	
13,500	54,000	.005633	.000300	.....	.....	
13,750	55,000	.005867	.000234	.....	.....	
14,000	56,000	.006100	.000233	.....	.....	
14,250	57,000	.006467	.000367	.....	.....	
14,500	58,000	.006900	.000433	.....	.....	
14,750	59,000	.007267	.000367	.....	.....	
15,000	60,000	.007833	.000566	.....	.....	
15,500	62,000	.008667	.000834	.....	.....	
16,000	64,000	.0100	.001333	.....	.....	
17,500	70,000	.0133	.0033	.....	.....	
19,000	76,000	.0167	.0034	.....	.....	
20,500	82,000	.0200	.0033	.....	.....	
22,000	88,000	.0233	.0033	.....	.....	
23,000	92,000	.0267	.0034	.....	.....	
24,000	96,000	.0267	.0000	.....	.....	
25,000	100,000	.0333	.0066	.....	.....	
26,000	104,000	.0367	.0034	.....	.....	
27,000	108,000	.0433	.0066	.....	.....	
28,000	112,000	.0500	.0067	.....	.....	
28,980	115,920	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	115,920
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.0600
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.044
Reduction in area after rupture, per cent of original section		15.0
Position of rupture		".30 from neck
Character of broken surface		fine granular
Elongation of inch sections		".04, ".04, ".10

SPECIAL GRADE OF STEEL.

No. 5562.

Marks, 61–S.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001033	.000366	.....	.....	
10,000	40,000	.001367	.000334	0.	.....	
12,500	50,000	.001700	.000333	.....	.....	
15,000	60,000	.002067	.000367	0.	.....	
16,250	65,000	.002233	.000166	.....	.....	
17,500	70,000	.002433	.000200	.....	.....	
17,750	71,000	.002467	.000034	.....	.....	
18,000	72,000	.002533	.000066	.....	.....	Elastic limit
18,250	73,000	.004500	.001967	.....	.....	
18,500	74,000	.005600	.001100	.....	.....	
18,750	75,000	.006000	.000400	.....	.....	
19,000	76,000	.006667	.000667	.....	.....	
19,500	78,000	.007567	.000900	.....	.....	
20,000	80,000	.010667	.003100	.....	.....	
22,000	88,000	.0133	.002633	.....	.....	
23,000	92,000	.0167	.0034	.....	.....	
24,000	96,000	.0200	.0033	.....	.....	
25,000	100,000	.0233	.0033	.....	.....	
26,000	104,000	.0267	.0034	.....	.....	
27,000	108,000	.0300	.0033	.....	.....	
28,000	112,000	.0333	.0033	.....	.....	
29,000	116,000	.0400	.0067	.....	.....	
30,000	120,000	.0467	.0067	.....	.....	
31,000	124,000	.0533	.0066	.....	.....	
32,000	128,000	.0633	.0100	.....	.....	
33,000	132,000	.0933	.0300	.....	.....	
33,120	132,480	.1067	.0134	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	132,480
Elastic limit per square inch of original section	do...	72,000
Elongation per inch after rupture	inch..	.1500
Elongation per inch under strain at elastic limit	do...	.002533
Reduction in diameter at point of rupture	do...	.104
Reduction in area after rupture, per cent of original section		33.5
Position of rupture		at middle of stem
Character of broken surface		silky, with fine granulation near circumference
Elongation of inch sections		″.10, ″.25*, ″.10

SPECIAL STEEL.

No. 5575.

Marks, No. 65.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000333	.000200	.....	.....	
4,000	20,000	.000667	.000334	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001367	.000367	.....	.....	
10,000	50,000	.001733	.000366	0.	.....	
11,000	55,000	.001933	.000200	.....	.....	
12,000	60,000	.002133	.000200	0.	.....	
13,000	65,000	.002333	.000200	.....	.....	
13,200	66,000	.002400	.000067	.....	.....	
13,400	67,000	.002467	.000067	.....	.....	Elastic limit. Load fell.
12,200	61,000	.005000	.002533	.....	.....	
12,400	62,000	.005500	.000500	.....	.....	
12,600	63,000	.0100	.0045	.....	.....	
13,000	65,000	.0133	.0033	.....	.....	
13,600	68,000	.0167	.0034	.....	.....	
14,000	70,000	.0200	.0033	.....	.....	
14,400	72,000	.0233	.0033	.....	.....	
14,800	74,000	.0267	.0034	.....	.....	
15,200	76,000	.0300	.0033	.....	.....	
16,000	80,000	.0333	.0033	.....	.....	
16,800	84,000	.0433	.0100	.....	.....	
17,600	88,000	.0533	.0100	.....	.....	
18,400	92,000	.0700	.0167	.....	.....	
19,200	96,000	.1067	.0367	.....	.....	
19,420	97,100	.1433	.0366	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	97,100
Elastic limit per square inch of original section	do...	67,000
Elongation per inch after rupture	inch..	.2133
Elongation per inch under strain at elastic limit	do...	.002467
Reduction in diameter at point of rupture	do...	.135
Reduction in area after rupture, per cent of original section		46.2
Position of rupture		at middle of stem
Character of broken surface		fine silky, cup shaped
Elongation of inch sections		″.14, ″.36*, ″.14

SPECIAL BARREL.

No. 5576.

Marks, No. 66.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000333	.000200	.....	.....	
4,000	20,000	.000667	.000334	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001367	.000367	.....	.....	
10,000	50,000	.001700	.000333	0.	.....	
11,000	55,000	.001867	.000167	.....	.....	
11,200	56,000	.001900	.000033	.....	.....	Elastic limit.
11,400	57,000	.002000	.000100	.....	.....	
11,600	58,000	.003000	.001000	.....	.....	
						Load fell.
11,000	55,000	.004000	.001000	.....	.....	
11,200	56,000	.005000	.001000	.....	.....	
11,400	57,000	.006667	.001667	.....	.....	
11,600	58,000	.007167	.000500	.....	.....	
11,800	59,000	.007733	.000566	.....	.....	
12,000	60,000	.008500	.000767	.....	.....	
12,800	64,000	.0133	.0048	.....	.....	
13,600	68,000	.0167	.0034	.....	.....	
14,400	72,000	.0200	.0033	.....	.....	
15,200	76,000	.0233	.0033	.....	.....	
16,000	80,000	.0267	.0034	.....	.....	
16,800	84,000	.0300	.0033	.....	.....	
17,600	88,000	.0333	.0033	.....	.....	
18,400	92,000	.0367	.0034	.....	.....	
19,200	96,000	.0400	.0033	.....	.....	
20,000	100,000	.0433	.0033	.....	.....	
20,800	104,000	.0500	.0067	.....	.....	
21,600	108,000	.0633	.0133	.....	.....	
22,400	112,000	.0800	.0167	.....	.....	
23,060	115,300	.1300	.0500	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	115,300
Elastic limit per square inch of original section	do...	56,000
Elongation per inch after rupture	inch..	.1467
Elongation per inch under strain at elastic limit	do...	.001900
Reduction in diameter at point of rupture	do...	.055
Reduction in area after rupture, per cent of original section		20.5
Position of rupture		1".66 from neck
Character of broken surface		fine granular
Elongation of inch sections		".12, ".20*, ".12

SPECIAL BARREL.

No. 5577.

Marks, No. 66.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000167	.000167	0.	.....	
2,000	10,000	.000333	.000166	.....	.....	
4,000	20,000	.000700	.000367	.....	.....	
6,000	30,000	.001067	.000367	.....	.....	
8,000	40,000	.001433	.000366	.....	.....	
10,000	50,000	.001767	.000334	0.	.....	
10,800	54,000	.001933	.000166	.....	.....	Elastic limit.
						Load fell.
10,400	52,000	.003633	.001700	.....	.....	
10,600	53,000	.004667	.001034	.....	.....	
10,800	54,000	.005667	.001000	.....	.....	
11,000	55,000	.006333	.000666	.....	.....	
11,200	56,000	.007000	.000667	.....	.....	
12,000	60,000	.0100	.0030	.....	.....	
12,800	64,000	.0133	.0033	.....	.....	
13,600	68,000	.0167	.0034	.....	.....	
14,400	72,000	.0200	.0033	.....	.....	
15,200	76,000	.0233	.0033	.....	.....	
16,000	80,000	.0267	.0034	.....	.....	
16,800	84,000	.0300	.0033	.....	.....	
17,600	88,000	.0333	.0033	.....	.....	
18,400	92,000	.0367	.0034	.....	.....	
19,200	96,000	.0400	.0033	.....	.....	
20,000	100,000	.0467	.0067	.....	.....	
20,800	104,000	.0567	.0100	.....	.....	
21,600	108,000	.0667	.0100	.....	.....	
22,400	112,000	.0900	.0233	.....	.....	
22,610	113,050	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	113,050
Elastic limit per square inch of original section	do...	54,000
Elongation per inch after rupture	inch..	.0933
Elongation per inch under strain at elastic limit	do...	.001933
Reduction in diameter at point of rupture	do...	.025
Reduction in area after rupture, per cent of original section		9.5
Position of rupture		1″.09 from neck
Character of broken surface		fine granular
Elongation of inch sections		″.09, ″.10, *″.09*

No. 5578.

Marks, No. 67.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001067	.000367	.....	.....	
10,000	40,000	.001433	.000366	0.	.....	
12,500	50,000	.001800	.000367	.....	.....	
15,000	60,000	.002167	.000367	0.	.....	
16,750	67,000	.002433	.000266	.....	.....	Elastic limit. Load fell.
16,500	66,000	.006667	.004234	.....	.....	
16,750	67,000	.007500	.000833	.....	.....	
17,000	68,000	.008333	.000833	.....	.....	
17,500	70,000	.009333	.001000	.....	.....	
18,000	72,000	.0133	.003967	.....	.....	
19,000	76,000	.0167	.0034	.....	.....	
20,000	80,000	.0200	.0033	.....	.....	
21,000	84,000	.0233	.0033	.....	.....	
22,000	88,000	.0267	.0034	.....	.....	
23,000	92,000	.0300	.0033	.....	.....	
24,000	96,000	.0333	.0033	.....	.....	
25,000	100,000	.0367	.0034	.....	.....	
26,000	104,000	.0467	.0100	.....	.....	
27,000	108,000	.0533	.0066	.....	.....	
28,000	112,000	.0667	.0134	.....	.....	
28,880	115,520	.1233	.0566	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	115,520
Elastic limit per square inch of original section	do...	67,000
Elongation per inch after rupture	inch..	.1700
Elongation per inch under strain at elastic limit	do...	.002433
Reduction in diameter at point of rupture	do...	.104
Reduction in area after rupture, per cent of original section		33.5
Position of rupture		1".5 from neck
Character of broken surface		silky, interspersed with fine granulation at the circumference
Elongation of inch sections		".11, ".27*, ".13

No. 5579.

Marks, No. 67.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000333	.000200	.....	.....	
4,000	20,000	.000667	.000334	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001333	.000333	.....	.....	
10,000	50,000	.001667	.000334	0.	.....	
11,000	55,000	.001833	.000166	.....	.....	
12,000	60,000	.002033	.000200	0.	.....	
13,000	65,000	.002200	.000167	.....	.....	
13,200	66,000	.002267	.000067	.....	.....	
13,600	68,000	.002300	.000033	.....	.....	Elastic limit. Load fell.
13,000	65,000	.003267	.000967	.....	.....	
13,200	66,000	.004667	.001400	.....	.....	
13,400	67,000	.007433	.002766	.....	.....	
13,600	68,000	.008333	.000900	.....	.....	
14,400	72,000	.0100	.001667	.....	.....	
15,200	76,000	.0133	.0033	.....	.....	
16,000	80,000	.0167	.0034	.....	.....	
16,800	84,000	.0200	.0033	.....	.....	
17,600	88,000	.0233	.0033	.....	.....	
18,400	92,000	.0300	.0067	.....	.....	
19,200	96,000	.0333	.0033	.....	.....	
20,000	100,000	.0400	.0067	.....	.....	
20,800	104,000	.0433	.0033	.....	.....	
21,600	108,000	.0567	.0134	.....	.....	
22,400	112,000	.0667	.0100	.....	.....	
23,220	116,100	.1167	.0500	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	116,100
Elastic limit per square inch of original section	do...	68,000
Elongation per inch after rupture	inch...	.1767
Elongation per inch under strain at elastic limit	do...	.002300
Reduction in diameter at point of rupture	do...	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		1".4 from neck
Character of broken surface		fine silky, with trace of granulation
Elongation of inch sections		".11 ".28*, ".14

No. 5604.

Marks, 68–1.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000667	.000367	.....	.....	
6,000	30,000	.001033	.000366	.....	.....	
8,000	40,000	.001400	.000367	0.	.....	
10,000	50,000	.001733	.000333	.....	.....	
11,000	55,000	.001900	.000167	.....	.....	
12,000	60,000	.002100	.000200	0.	.....	
13,000	65,000	.002300	.000200	.....	.....	
13,800	69,000	.002467	.000167	.....	.....	Elastic limit.
14,000	70,000	.002533	.000066	.000100	.000100	
14,200	71,000	.002667	.000134	.....	.....	
14,400	72,000	.002900	.000233	.....	.....	
14,600	73,000	.004533	.001633	.....	.....	
14,800	74,000	.005200	.000667	.....	.....	
15,000	75,000	.006000	.000800	.....	.....	
15,200	76,000	.006467	.000467	.....	.....	
15,400	77,000	.007167	.000700	.....	.....	
15,600	78,000	.007767	.000600	.....	.....	
15,800	79,000	.008333	.000566	.....	.....	
16,000	80,000	.009167	.000834	.005867	.005767	
17,000	85,000	.0133	.004133	.....	.....	
18,000	90,000	.0167	.0034	.....	.....	
19,000	95,000	.0200	.0033	.....	.....	
20,000	100,000	.0233	.0033	.....	.....	
21,000	105,000	.0300	.0067	.....	.....	
22,000	110,000	.0333	.0033	.....	.....	
23,000	115,000	.0433	.0100	.....	.....	
24,000	120,000	.0500	.0067	.....	.....	
25,000	125,000	.0733	.0233	.....	.....	
25,410	127,050	.1067	.0334	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	127,050
Elastic limit per square inch of original section	do...	69,000
Elongation per inch after rupture	inch..	.1300
Elongation per inch under strain at elastic limit	do...	.002467
Reduction in diameter at point of rupture	do...	.065
Reduction in area after rupture, per cent of original section		23.9
Position of rupture		1″.6 from neck
Character of broken surface		fine granular, radiating from a silky spot at the center
Elongation of inch sections		″.09, ″.21[x], ″.09

No. 5605.

Marks, 68–2.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	0.	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000633	.000333	.....	.....	
6,000	30,000	.001000	.000367	.....	.....	
8,000	40,000	.001333	.000333	0.	.....	
10,000	50,000	.001700	.000367	.....	.....	
12,000	60,000	.002067	.000367	0.	.....	
14,000	70,000	.002433	.000366	.000033	.000033	
14,200	71,000	.002500	.000067	.....	.....	
14,400	72,000	.002533	.000033	.....	.....	
14,600	73,000	.002567	.000034	.....	.....	
14,800	74,000	.002600	.000033	.....	.....	Elastic limit.
15,000	75,000	.002767	.000167	.....	.....	
15,200	76,000	.008200	.005433	.005067	.005034	
16,000	80,000	.0100	.0018	.....	.....	
17,000	85,000	.0133	.0033	.....	.....	
18,000	90,000	.0167	.0034	.....	.....	
19,000	95,000	.0233	.0066	.....	.....	
20,000	100,000	.0267	.0034	.....	.....	
21,000	105,000	.0333	.0066	.....	.....	
22,000	110,000	.0400	.0067	.....	.....	
23,000	115,000	.0467	.0067	.....	.....	
24,000	120,000	.0633	.0166	.....	.....	
25,000	125,000	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	125,000
Elastic limit per square inch of original section	do...	74,000
Elongation per inch after rupture	inch..	.1633
Elongation per inch under strain at elastic limit	do...	.002600
Reduction in diameter at point of rupture	do...	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		1″.6 from neck
Character of broken surface		silky, interspersed with fine granulation; cup shaped
Elongation of inch sections		″.11, ″.27*, ″.11

No. 5606.

Marks, 68–3.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000333	.000200	.....	.....	
4,000	20,000	.000667	.000334	.....	.....	
6,000	30,000	.001033	.000366	.....	.....	
8,000	40,000	.001367	.000334	0.	.....	
10,000	50,000	.001700	.000333	.....	.....	
11,000	55,000	.001867	.000167	.....	.....	
12,000	60,000	.002067	.000200	.....	.....	
13,000	65,000	.002267	.000200	.000033	.000033	
13,200	66,000	.002333	.000066	.....	.....	
13,400	67,000	.002367	.000034	.....	.....	Elastic limit.
13,600	68,000	.002467	.000100	.....	.....	
13,800	69,000	.002533	.000006	.....	.....	
14,000	70,000	.006133	.003600	.003367	.003334	
15,000	75,000	.0100	.003867	.....	.....	
16,000	80,000	.0133	.0033	.....	.....	
17,000	85,000	.0167	.0034	.....	.....	
18,000	90,000	.0200	.0033	.....	.....	
19,000	95,000	.0267	.0067	.....	.....	
20,000	100,000	.0333	.0066	.....	.....	
21,000	105,000	.0400	.0067	.....	.....	
22,000	110,000	.0500	.0100	.....	.....	
23,000	115,000	.0667	.0167	.....	.....	
23,940	119,700	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	119,700
Elastic limit per square inch of original section	do...	67,000
Elongation per inch after rupture	inch..	.1533
Elongation per inch under strain at elastic limit	do ..	.002367
Reduction in diameter at point of rupture	do...	.095
Reduction in area after rupture, per cent of original section	.....	34.0
Position of rupture	.....	at middle of stem
Character of broken surface	.....	silky, interspersed with fine granulation; cup shaped
Elongation of inch sections	.....	".10, ".26", ".10

No. 5607.

Marks, 68–4.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000333	.000200	.....	.....	
4,000	20,000	.000667	.000334	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001367	.000367	.....	.....	
10,000	50,000	.001700	.000333	0.	.....	
11,000	55,000	.001867	.000167	.....	.....	
12,000	60,000	.002067	.000200	.....	.....	
13,000	65,000	.002233	.000166	.....	.....	
14,000	70,000	.002433	.000200	0.	.....	
14,200	71,000	.002467	.000034	.....	.....	
14,400	72,000	.002500	.000033	.....	.....	
14,600	73,000	.002533	.000033	.....	.....	
14,800	74,000	.002567	.000034	.....	.....	
15,000	75,000	.002633	.000066	.....	.....	
15,200	76,000	.002700	.000067	.....	.....	Elastic limit.
15,400	77,000	.002800	.000100	.....	.....	
15,600	78,000	.003667	.000867	.....	.....	
		.007167	.003500	.....	.....	
15,800	79,000	.007700	.000533	.....	.....	
16,000	80,000	.008333	.000633	.005167	.005167	
17,000	85,000	.0100	.001667	.....	.....	
18,000	90,000	.0167	.0067	.....	.....	
19,000	95,000	.0200	.0033	.....	.....	
20,000	100,000	.0233	.0033	.....	.....	
21,000	105,000	.0267	.0034	.....	.....	
22,000	110,000	.0333	.0066	.....	.....	
23,000	115,000	.0400	.0067	.....	.....	
24,000	120,000	.0467	.0067	.....	.....	
25,000	125,000	.0633	.0166	.....	.....	
25,970	129,850	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	129,850
Elastic limit per square inch of original section	do...	76,000
Elongation per inch after rupture	inch..	.1467
Elongation per inch under strain at elastic limit	do...	.002700
Reduction in diameter at point of rupture	do...	.085
Reduction in area after rupture, per cent of original section		30.7
Position of rupture		1″.15 from neck
Character of broken surface		silky, interspersed with fine granulation; cup shaped
Elongation of inch section		″.15, ″.20,* ″.09

STEEL FROM BREECH AND MUZZLE OF A ROLLED RIFLE BARREL, CAL. .30, WHICH HAS BEEN ANNEALED IN CHARCOAL.

No. 5611.

Marks, 63 B.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000667	.000367	.....	.....	
6,000	30,000	.001033	.000366	.....	.....	
8,000	40,000	.001367	.000334	.....	.....	
10,000	50,000	.001700	.000333	0.	.....	
11,000	55,000	.001867	.000167	.....	.....	
11,200	56,000	.001867	0.	.....	.....	
11,400	57,000	.001900	.000033	.....	.....	Elastic limit. Load fell.
11,000	55,000	.003667	.001767	.....	.....	
11,200	56,000	.006000	.002333	.....	.....	
11,400	57,000	.007000	.001000	.....	.....	
11,600	58,000	.007667	.000667	.....	.....	
11,800	59,000	.008200	.000533	.....	.....	
12,000	60,000	.009267	.001067	.006833	.006833	
12,800	64,000	.0133	.004033	.....	.....	
13,600	68,000	.0167	.0034	.....	.....	
14,400	72,000	.0200	.0033	.....	.....	
15,200	76,000	.0233	.0033	.....	.....	
16,000	80,000	.0267	.0034	.....	.....	
16,800	84,000	.0300	.0033	.....	.....	
17,600	88,000	.0333	.0033	.....	.....	
18,400	92,000	.0400	.0067	.....	.....	
19,200	96,000	.0467	.0067	.....	.....	
20,000	100,000	.0567	.0100	.....	.....	
20,800	104,000	.0733	.0166	.....	.....	
21,600	108,000	.1333	.0600	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	108,000
Elastic limit per square inch of original section	do...	57,000
Elongation per inch after rupture	inch..	.1733
Elongation per inch under strain at elastic limit	do...	.001900
Reduction in diameter at point of rupture	do...	.075
Reduction in area after rupture, per cent of original section		27.4
Position of rupture		1".7 from neck
Character of broken surface		silky, interspersed with fine granulation
Elongation of inch sections		".13, ".26*, ".13

No. 5612.

Marks, 63 M.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000667	.000367	.....	.....	
6,000	30,000	.001033	.000366	.....	.....	
8,000	40,000	.001367	.000334	.....	.....	
10,000	50,000	.001733	.000366	0.	.....	
11,000	55,000	.001933	.000200	.....	.....	
11,200	56,000	.001967	.000034	.....	.....	
11,400	57,000	.002000	.000033	.....	.....	
11,600	58,000	.002033	.000033	.....	.....	
11,800	59,000	.002067	.000034	.....	.....	
12,000	60,000	.002100	.000033	0.	.....	
12,200	61,000	.002133	.000033	.....	.....	
12,400	62,000	.002167	.000034	.....	.....	
12,600	63,000	.002200	.000033	.....	.....	
12,800	64,000	.002293	.000033	.....	.....	Elastic limit.
						Load fell.
12,000	60,000	.003800	.001067	.....	.....	
12,200	61,000	.004000	.000700	.....	.....	
12,400	62,000	.006167	.002167	.....	.....	
12,600	63,000	.008500	.002333	.....	.....	
12,800	64,000	.009000	.000500	.....	.....	
13,000	65,000	.009633	.000633	.006867	.006867	
13,600	68,000	.0133	.003667	.....	.....	
14,400	72,000	.0167	.0034	.....	.....	
15,200	76,000	.0200	.0033	.....	.....	
16,000	80,000	.0233	.0033	.....	.....	
16,800	84,000	.0267	.0034	.....	.....	
17,600	88,000	.0300	.0033	.....	.....	
18,400	92,000	.0333	.0033	.....	.....	
19,200	96,000	.0400	.0067	.....	.....	
20,000	100,000	.0467	.0067	.....	.....	
20,800	104,000	.0567	.0100	.....	.....	
21,600	108,000	.0700	.0133	.....	.....	
22,400	112,000	.1100	.0400	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	112,000
Elastic limit per square inch of original section	do...	64,000
Elongation per inch after rupture	inch..	.1700
Elongation per inch under strain at elastic limit	do...	.002233
Reduction in diameter at point of rupture	do...	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		".95 from neck
Character of broken surface		fine silky; cup-shaped
Elongation of inch sections		".10, ".15, ".26*

BESSEMER STEEL.

No. 5613.

Marks, 68–5.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000333	.000200	.....	.....	
4,000	20,000	.000667	.000334	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001367	.000367	.....	.....	
10,000	50,000	.001700	.000333	0.	.....	
11,000	55,000	.001867	.000167	.....	.....	
12,000	60,000	.002067	.000200	.000033	.000033	
13,000	65,000	.002233	.000166	.....	.....	
14,000	70,000	.002400	.000167	.000033	0.	
14,200	71,000	.002467	.000067	.....	.....	
14,400	72,000	.002533	.000066	.....	.....	
14,600	73,000	.002567	.000034	.....	.....	
14,800	74,000	.002600	.000033	.....	.....	Elastic limit.
		.006900	.004300	.....	.....	
15,000	75,000	.007800	.000900	.....	.....	
15,200	76,000	.008167	.000367	.....	.....	
15,400	77,000	.008833	.000666	.....	.....	
15,600	78,000	.009467	.000634	.....	.....	
15,800	79,000	.010367	.000900	.007133	.007100	
16,000	80,000	.0133	.002933	.....	.....	
17,600	88,000	.0167	.0034	.....	.....	
18,400	92,000	.0200	.0033	.....	.....	
19,200	96,000	.0233	.0033	.....	.....	
20,000	100,000	.0300	.0067	.....	.....	
20,800	104,000	.0333	.0033	.....	.....	
21,600	108,000	.0367	.0034	.....	.....	
22,400	112,000	.0433	.0066	.....	.....	
23,200	116,000	.0533	.0100	.....	.....	
24,000	120,000	.0633	.0100	.....	.....	
24,800	124,000	.0900	.0267	.....	.....	
24,900	124,500	.1067	.0167	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	124,500
Elastic limit per square inch of original section	do...	74,000
Elongation per inch after rupture	inch..	.1533
Elongation per inch under strain at elastic limit	do...	.002900
Reduction in diameter at point of rupture	do...	.095
Reduction in area after rupture, per cent of original section		34.0
Position of rupture		1″.14 from neck
Character of broken surface		silky, interspersed with fine granulation
Elongation of inch sections		″.19*, ″.18, ″.09

BESSEMER STEEL, SAME AS NO. 5613.

No. 5614.

Marks, 68–7.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000300	.000200	.....	.....	
4,000	20,000	.000667	.000367	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001333	.000333	.....	.....	
10,000	50,000	.001667	.000334	.....	.....	
12,000	60,000	.002000	.000333	0.	.....	
13,000	65,000	.002167	.000167	.....	.....	
14,000	70,000	.002367	.000200	0.	.....	Elastic limit. Load fell.
13,400	67,000	.003600	.001233	.....	.....	
13,600	68,000	.004433	.000833	.....	.....	
13,800	69,000	.006867	.002434	.....	.....	
14,000	70,000	.008967	.002100	.006133	.006133	
14,800	74,000	.0133	.004333	.....	.....	
15,600	78,000	.0167	.0034	.....	.....	
16,400	82,000	.0200	.0033	.....	.....	
17,200	86,000	.0233	.0033	.....	.....	
18,000	90,000	.0267	.0034	.....	.....	
18,800	94,000	.0333	.0066	.....	.....	
19,600	98,000	.0367	.0034	.....	.....	
20,400	102,000	.0433	.0066	.....	.....	
21,600	106,000	.0500	.0067	.....	.....	
22,000	110,000	.0600	.0100	.....	.....	
22,800	114,000	.0833	.0233	.....	.....	
23,000	115,000	.1000	.0167	.....	.....	
23,030	115,150	.1133	.0133	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	115,150
Elastic limit per square inch of original section	do...	70,000
Elongation per inch after rupture	inch..	.1633
Elongation per inch under strain at elastic limit	do...	.002367
Reduction in diameter at point of rupture	do...	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		1″.24 from neck
Character of broken surface		silky, interspersed with fine granulation
Elongation of inch sections		″.19, ″.21*, ″.09

BESSEMER STEEL, SAME AS NO. 5614. ROLLED BARREL ANNEALED IN CHARCOAL.

No. 5615.

Marks, 68–2c.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000700	.000400	.....	.....	
6,000	30,000	.001033	.000333	.....	.....	
8,000	40,000	.001367	.000334	.....	.....	
10,000	50,000	.001733	.000366	0.	.....	
12,000	60,000	.002067	.000334	0.	.....	
13,000	65,000	.002233	.000166	.....	.....	
13,200	66,000	.002300	.000067	.....	.....	Elastic limit.
13,400	67,000	.002400	.000100	.....	.....	
						Load fell.
13,600	68,000	.003000	.000600	.....	.....	
12,800	64,000	.003200	.000200	.....	.....	
13,000	65,000	.004667	.001467	.....	.....	
13,200	66,000	.006167	.001500	.....	.....	
13,400	67,000	.007333	.001166	.....	.....	
13,600	68,000	.008000	.000667	.....	.....	
13,800	69,000	.008833	.000833	.....	.....	
14,000	70,000	.009633	.000800	.006867	.006867	
14,800	74,000	.0133	.003667	.....	.....	
15,600	78,000	.0167	.0034	.....	.....	
16,400	82,000	.0200	.0033	.....	.....	
17,200	86,000	.0233	.0033	.....	.....	
18,000	90,000	.0267	.0034	.....	.....	
18,800	94,000	.0300	.0033	.....	.....	
19,600	98,000	.0333	.0033	.....	.....	
20,400	102,000	.0400	.0067	.....	.....	
21,200	106,000	.0467	.0067	.....	.....	
22,000	110,000	.0533	.0066	.....	.....	
22,800	114,000	.0667	.0134	.....	.....	
23,000	115,000	.0733	.0066	.....	.....	
23,200	116,000	.0800	.0067	.....	.....	
23,400	117,000	.0900	.0100	.....	.....	
23,580	117,900	.1067	.0167	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	117,900
Elastic limit per square inch of original section	do...	66,000
Elongation per inch after rupture	inch..	.1333
Elongation per inch under strain at elastic limit	do...	.002300
Reduction in diameter at point of rupture	do...	.065
Reduction in area after rupture, per cent of original section		23.9
Position of rupture		″.85 from neck
Character of broken surface		silky and fine granular metal interspersed
Elongation of inch sections		″.21*, ″.11, ″.08

BESSEMER STEEL, SAME AS NO. 5614. ROLLED BARREL COOLED IN AIR.

No. 5616.

Marks, 68–2–A.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000300	.000200	.....	.....	
4,000	20,000	.000667	.000367	.....	.....	
6,000	30,000	.001033	.000366	.....	.....	
8,000	40,000	.001400	.000367	0.	.....	
10,000	50,000	.001733	.000333	.....	.....	
11,000	55,000	.001900	.000167	.....	.....	
12,000	60,000	.002133	.000233	.000033	.000033	
12,200	61,000	.002167	.000034	.....	.....	
12,400	62,000	.002233	.000066	.....	.....	
12,600	63,000	.002267	.000034	.....	.....	
13,800	64,000	.002300	.000033	.....	.....	
13,000	65,000	.002333	.000033	.....	.....	
13,200	66,000	.002367	.000034	.....	.....	
13,400	67,000	.002433	.000066	.....	.....	
13,600	68,000	.002500	.000067	.....	.....	
13,800	69,000	.002533	.000033	.....	.....	
14,000	70,000	.002567	.000034	.000133	.000100	
14,200	71,000	.002633	.000066	.....	.....	Elastic limit.
14,400	72,000	.002767	.000134	.....	.....	
14,600	73,000	.002900	.000133	.....	.....	
14,800	74,000	.003267	.000367	.....	.....	
15,000	75,000	.005967	.002700	.....	.....	
15,200	76,000	.006533	.000566	.....	.....	
15,400	77,000	.006900	.000367	.....	.....	
15,600	78,000	.007667	.000767	.....	.....	
15,800	79,000	.008667	.001000	.....	.....	
16,000	80,000	.009267	.000600	.006033	.005900	
16,800	84,000	.0133	.004033	.....	.....	
17,600	88,000	.0167	.0034	.....	.....	
18,400	92,000	.0200	.0033	.....	.....	
19,200	96,000	.0233	.0033	.....	.....	
20,000	100,000	.0267	.0034	.....	.....	
20,800	104,000	.0300	.0033	.....	.....	
21,600	108,000	.0333	.0033	.....	.....	
22,400	112,000	.0400	.0067	.....	.....	
23,200	116,000	.0467	.0067	.....	.....	
24,000	120,000	.0533	.0066	.....	.....	
24,800	124,000	.0667	.0134	.....	.....	
25,540	127,700	.1067	.0400	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	127,700
Elastic limit per square inch of original section	do...	71,000
Elongation per inch after rupture	inch..	.1633
Elongation per inch under strain at elastic limit	do...	.002633
Reduction in diameter at point of rupture	do...	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		1″ from neck
Character of broken surface		fine silky; trace of granulation; cup shaped
Elongation of inch sections		″.24*, ″.15, ″.10

BESSEMER STEEL.

No. 5641.

Marks, 68–8.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000633	.000333	.....	.....	
6,000	30,000	.000967	.000334	.....	.....	
8,000	40,000	.001333	.000366	.....	.....	
10,000	50,000	.001667	.000334	0.	.....	
11,000	55,000	.001833	.000166	.....	.....	
12,000	60,000	.002033	.000200	0.	.....	
13,000	65,000	.002200	.000167	.....	.....	
14,000	70,000	.002433	.000233	.....	.....	Elastic limit.
		.006200	.003767	.....	.....	
14,200	71,000	.007133	.000933	.....	.....	
14,400	72,000	.007733	.000600	.....	.....	
14,600	73,000	.008300	.000567	.....	.....	
14,800	74,000	.008833	.000533	.....	.....	
15,000	75,000	.009433	.000600	.....	.....	
15,200	76,000	.010433	.001000	.....	.....	
16,000	80,000	.0133	.002867	.....	.....	
16,800	84,000	.0167	.0034	.....	.....	
17,600	88,000	.0200	.0033	.....	.....	
18,400	92,000	.0233	.0033	.....	.....	
19,200	96,000	.0267	.0034	.....	.....	
20,000	100,000	.0300	.0033	.....	.....	
20,800	104,000	.0367	.0067	.....	.....	
21,600	108,000	.0433	.0066	.....	.....	
22,400	112,000	.0500	.0067	.....	.....	
23,200	116,000	.0633	.0133	.....	.....	
24,000	120,000	.0933	.0300	.....	.....	
24,070	120,350	.1033	.0100	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	120,350
Elastic limit per square inch of original section	do...	70,000
Elongation per inch after rupture	inch..	.1733
Elongation per inch under strain at elastic limit	do...	.002433
Reduction in diameter at point of rupture	do...	.115
Reduction in area after rupture, per cent of original section		40.3
Position of rupture		at middle of stem
Character of broken surface		fine silky; cup shaped
Elongation of inch sections		″.11, ″.30*, ″.11

BESSEMER STEEL.

No. 5642.

Marks, 68–9.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	0.	.....	
4,000	20,000	.000667	.000367	.....	.....	
6,000	30,000	.001033	.000366	.....	.....	
8,000	40,000	.001400	.000367	.....	.....	
10,000	50,000	.001767	.000367	0.	.....	
11,000	55,000	.001900	.000133	.....	.....	
12,000	60,000	.002100	.000200	0.	.....	
13,000	65,000	.002300	.000200	.....	.....	
14,000	70,000	.002500	.000200	.....	.....	
14,200	71,000	.002567	.000067	.....	.....	
14,400	72,000	.002633	.000066	.....	.....	Elastic limit.
14,600	73,000	.006600	.003967	.....	.....	
14,800	74,000	.007300	.000700	.....	.....	
15,000	75,000	.007967	.000667	.....	.....	
15,200	76,000	.008667	.000700	.....	.....	
15,400	77,000	.009233	.000566	.....	.....	
15,600	78,000	.009833	.000600	.....	.....	
16,000	80,000	.0133	.003467	.....	.....	
16,800	84,000	.0167	.0034	.....	.....	
17,600	88,000	.0167+	.0000+	.....	.....	
18,400	92,000	.0200	.0033	.....	.....	
19,200	96,000	.0233	.0033	.....	.....	
20,000	100,000	.0267	.0034	.....	.....	
20,800	104,000	.0300	.0033	.....	.....	
21,600	108,000	.0367	.0067	.....	.....	
22,400	112,000	.0433	.0066	.....	.....	
23,200	116,000	.0500	.0067	.....	.....	
24,000	120,000	.0633	.0133	.....	.....	
24,680	123,400	.1033	.0400	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	123,400
Elastic limit per square inch of original section	do...	72,000
Elongation per inch after rupture	inch..	.1567
Elongation per inch under strain at elastic limit	do...	.002633
Reduction in diameter at point of rupture	do...	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		1″.47 from neck
Character of broken surface		silky, interspersed with fine granulation; cup shaped
Elongation of inch sections		″.09, ″.26*, ″.12

BESSEMER STEEL.

No. 5643.

Marks, 68–11.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	.....	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000700	.000400	.....	.....	
6,000	30,000	.001067	.000367	.....	.....	
8,000	40,000	.001400	.000333	.....	.....	
10,000	50,000	.001733	.000333	.....	.....	
11,000	55,000	.001900	.000167	.....	.....	
12,000	60,000	.002100	.000200	.....	.....	
13,000	65,000	.002300	.000200	.....	.....	
14,000	70,000	.002500	.000200	.....	.....	
14,400	72,000	.002567	.000067	.....	.....	
14,600	73,000	.002633	.000066	.....	.....	Elastic limit. Load fell.
14,000	70,000	.004167	.001534	.....	.....	
14,200	71,000	.005233	.001066	.....	.....	
14,400	72,000	.006833	.001600	.....	.....	
14,600	73,000	.007667	.000834	.....	.....	
14,800	74,000	.008467	.000800	.....	.....	
15,000	75,000	.009000	.000533	.....	.....	
15,200	76,000	.009600	.000600	.....	.....	
16,000	80,000	.0133	.0037	.....	.....	
16,800	84,000	.0167	.0034	.....	.....	
17,600	88,000	.0200	.0033	.....	.....	
18,400	92,000	.0233	.0033	.....	.....	
19,200	96,000	.0267	.0034	.....	.....	
20,000	100,000	.0300	.0033	.....	.....	
20,800	104,000	.0367	.0067	.....	.....	
21,600	108,000	.0433	.0066	.....	.....	
22,400	112,000	.0533	.0100	.....	.....	
23,200	116,000	.0633	.0100	.....	.....	
24,000	120,000	.1000	.0367	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	120,000
Elastic limit per square inch of original section	do...	73,000
Elongation per inch after rupture	inch..	.1667
Elongation per inch under strain at elastic limit	do...	.002633
Reduction in diameter at point of rupture	do...	.135
Reduction in area after rupture, per cent of original section		46.2
Position of rupture		at middle of stem
Character of broken surface		fine silky; cup shaped
Elongation of inch sections		″.10, ″.30*, ″.10

BESSEMER STEEL FROM RIFLE BARREL ANNEALED IN AIR.

No. 5644.

Marks, 5–A.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000267	.000167	.....	.....	
4,000	20,000	.000633	.000366	.....	.....	
6,000	30,000	.000967	.000334	.....	.....	
8,000	40,000	.001300	.000333	.....	.....	
10,000	50,000	.001633	.000333	0.	.....	
12,000	60,000	.002000	.000367	0.	.....	
13,000	65,000	.002233	.000233	.....	.....	
14,000	70,000	.002433	.000200	.....	.....	
15,000	75,000	.002633	.000200	.....	.....	
15,200	76,000	.002700	.000067	.....	.....	Elastic limit.
		.005900	.003200	.....	.....	
15,400	77,000	.007500	.001600	.....	.....	
15,600	78,000	.008000	.000500	.....	.....	
15,800	79,000	.008533	.000533	.....	.....	
16,000	80,000	.009167	.000634	.....	.....	
16,800	84,000	.0133	.004133	.....	.....	
17,600	88,000	.0167	.0034	.....	.....	
18,400	92,000	.0200	.0033	.....	.....	
19,200	96,000	.0233	.0033	.....	.....	
20,000	100,000	.0233+	.0000+	.....	.....	
20,800	104,000	.0267	.0034	.....	.....	
21,600	108,000	.0333	.0066	.....	.....	
22,400	112,000	.0367	.0034	.....	.....	
23,200	116,000	.0433	.0066	.....	.....	
24,000	120,000	.0533	.0100	.....	.....	
24,800	124,000	.0633	.0100	.....	.....	
25,600	128,000	.0967	.0334	.....	.....	
25,610	128,050	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	128,050
Elastic limit per square inch of original section	do...	76,000
Elongation per inch after rupture	inch..	.1667
Elongation per inch under strain at elastic limit	do...	.002700
Reduction in diameter at point of rupture	do...	.125
Reduction in area after rupture, per cent of original section		43.3
Position of rupture		1″.26 from neck
Character of broken surface		fine silky, cup shaped
Elongation of inch sections		″.16, ″.24*, ″.10

BESSEMER STEEL FROM RIFLE BARREL ANNEALED IN CHARCOAL.

No. 5645.

Marks, 5–C.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000633	.000333	.....	.....	
6,000	30,000	.001000	.000367	.....	.....	
8,000	40,000	.001333	.000333	.....	.....	
10,000	50,000	.001667	.000334	0.	.....	
12,000	60,000	.002000	.000333	0.	.....	
13,000	65,000	.002200	.000200	.....	.....	
13,800	69,000	.002367	.000167	.....	.....	Elastic limit.
						Load fell.
13,000	65,000	.003300	.000933	.....	.....	
13,200	66,000	.003467	.000167	.....	.....	
13,400	67,000	.005000	.001533	.....	.....	
13,600	68,000	.006667	.001667	.....	.....	
13,800	69,000	.008667	.002000	.....	.....	
14,000	70,000	.009300	.000633	.....	.....	
14,200	71,000	.009667	.000367	.....	.....	
14,400	72,000	.010467	.000800	.....	.....	
15,200	76,000	.0133	.002833	.....	.....	
16,000	80,000	.0167	.0034	.....	.....	
16,800	84,000	.0200	.0033	.....	.....	
17,600	88,000	.0233	.0033	.....	.....	
18,400	92,000	.0267	.0034	.....	.....	
19,200	96,000	.0300	.0033	.....	.....	
20,000	100,000	.0333	.0033	.....	.....	
20,800	104,000	.0400	.0067	.....	.....	
21,600	108,000	.0500	.0100	.....	.....	
22,400	112,000	.0567	.0067	.....	.....	
23,200	116,000	.0700	.0133	.....	.....	
23,910	119,550	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	119,550
Elastic limit per square inch of original section	do...	69,000
Elongation per inch after rupture	inch..	.1567
Elongation per inch under strain at elastic limit	do...	.002367
Reduction in diameter at point of rupture	do...	.095
Reduction in area after rupture, per cent of original section		34.0
Position of rupture		″.85 from neck
Character of broken surface		fine silky, dark gray
Elongation of inch sections		″.25*, ″.12, ″.10

NEW PRODUCT.

FIRST HEAT.—STEEL AS RECEIVED.

No. 5651.

Marks, X–1.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000667	.000367	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001367	.000367	.....	.....	
10,000	50,000	.001700	.000333	0.	.....	
12,000	60,000	.002067	.000367	.....	.....	
13,000	65,000	.002233	.000166	.....	.....	
14,000	70,000	.002467	.000234	0.	.....	
14,200	71,000	.002500	.000033	.....	.....	
14,400	72,000	.002533	.000033	.....	.....	
14,600	73,000	.002600	.000067	.....	.....	Elastic limit.
						Load fell.
14,200	71,000	.004000	.001400	.....	.....	
14,400	72,000	.005667	.001667	.....	.....	
14,600	73,000	.007333	.001666	.....	.....	
14,800	74,000	.009000	.001667	.....	.....	
15,000	75,000	.009800	.000800	.....	.....	
16,000	80,000	.0133	.0035	.....	.....	
16,800	84,000	.0167	.0034	.....	.....	
17,600	88,000	.0200	.0033	.....	.....	
18,400	92,000	.0233	.0033	.....	.....	
19,200	96,000	.0267	.0034	.....	.....	
20,000	100,000	.0333	.0066	.....	.....	
20,800	104,000	.0367	.0034	.....	.....	
21,600	108,000	.0433	.0066	.....	.....	
22,400	112,000	.0500	.0067	.....	.....	
23,200	116,000	.0633	.0133	.....	.....	
24,000	120,000	.0867	.0234	.....	.....	
24,260	121,300	.1133	.0266	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	121,300
Elastic limit per square inch of original section	do	73,000
Elongation per inch after rupture	inch	.1733
Elongation per inch under strain at elastic limit	do	.002600
Reduction in diameter at point of rupture	do	.135
Reduction in area after rupture, per cent of original section		46.2
Position of rupture		″.95 from neck
Character of broken surface		fine silky
Elongation of inch sections		″.30*, ″.13, ″.09

FIRST HEAT.—BARREL ROLLED AND ANNEALED IN CHARCOAL.

No. 5653.

Marks, X-1-C.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000633	.000333	.....	.....	
6,000	30,000	.000967	.000334	.....	.....	
8,000	40,000	.001333	.000366	.....	.....	
10,000	50,000	.001667	.000334	0.	.....	
11,000	55,000	.001833	.000166	.....	.....	
11,200	56,000	.001867	.000034	.....	.....	Elastic limit.
11,400	57,000	.003000	.001133	.....	.....	
						Load fell.
11,000	55,000	.003467	.000467	.....	.....	
11,200	56,000	.003933	.000466	.....	.....	
11,400	57,000	.004677	.000734	.....	.....	
11,600	58,000	.005667	.001000	.....	.....	
11,800	59,000	.006600	.000933	.....	.....	
12,000	60,000	.007367	.000767	.....	.....	
12,200	61,000	.008267	.000900	.....	.....	
12,400	62,000	.008667	.000400	.....	.....	
12,600	63,000	.009200	.000533	.....	.....	
12,800	64,000	.010000	.000800	.....	.....	
13,600	68,000	.0133	.0033	.....	.....	
14,400	72,000	.0167	.0034	.....	.....	
15,200	76,000	.0200	.0033	.....	.....	
16,000	80,000	.0233	.0033	.....	.....	
16,800	84,000	.0267	.0034	.....	.....	
17,600	88,000	.0300	.0033	.....	.....	
18,400	92,000	.0367	.0067	.....	.....	
19,200	96,000	.0433	.0066	.....	.....	
20,000	100,000	.0533	.0100	.....	.....	
20,800	104,000	.0633	.0100	.....	.....	
21,600	108,000	.0900	.0267	.....	.....	
21,830	109,150	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	109,150
Elastic limit per square inch of original section	do...	56,000
Elongation per inch after rupture	inch..	.1233
Elongation per inch under strain at elastic limit	do...	.001867
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		".8 from neck
Character of broken surface		fine granular
Elongation of inch sections		".16", ".12, ".09

FIRST HEAT.—BARREL ROLLED AND ANNEALED IN AIR.

No. 5654.

Marks, X 1 A.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	0.	
2,000	10,000	.000333	.000200	.....	.....	
4,000	20,000	.000700	.000367	.....	.....	
6,000	30,000	.001033	.000333	.....	.....	
8,000	40,000	.001400	.000367	.....	.....	
10,000	50,000	.001767	.000367	0.	.....	
11,000	55,000	.001933	.000166	.....	.....	
12,000	60,000	.002133	.000200	0.	.....	
12,200	61,000	.002167	.000034	.....	.....	
12,400	62,000	.002200	.000033	.....	.....	
12,600	63,000	.002267	.000067	.....	.....	
12,800	64,000	.002300	.000033	.....	.....	
13,000	65,000	.002333	.000033	.....	.....	
13,200	66,000	.002367	.000034	.....	.....	
13,400	67,000	.002433	.000066	.....	.....	
13,600	68,000	.002500	.000067	.....	.....	Elastic limit.
13,800	69,000	.002667	.000167	.....	.....	
						Load fell.
13,400	67,000	.003133	.000466	.....	.....	
13,600	68,000	.003500	.000367	.....	.....	
13,800	69,000	.004667	.001167	.....	.....	
14,000	70,000	.006833	.002166	.....	.....	
14,200	71,000	.007633	.000800	.....	.....	
14,400	72,000	.008267	.000634	.....	.....	
15,200	76,000	.0133	.005033	.....	.....	
16,000	80,000	.0167	.0034	.....	.....	
16,800	84,000	.0200	.0033	.....	.....	
17,600	88,000	.0200+	.0000+	.....	.....	
18,400	92,000	.0233	.0033	.....	.....	
19,200	96,000	.0300	.0067	.....	.....	
20,000	100,000	.0333	.0033	.....	.....	
20,800	104,000	.0367	.0034	.....	.....	
21,600	108,000	.0433	.0066	.....	.....	
22,400	112,000	.0533	.0100	.....	.....	
23,200	116,000	.0633	.0100	.....	.....	
24,000	120,000	.0900	.0267	.....	.....	
24,030	120,150	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	120,150
Elastic limit per square inch of original section	do...	68,000
Elongation per inch after rupture	inch..	.1667
Elongation per inch under strain at elastic limit	do...	.002500
Reduction in diameter at point of rupture	do...	.125
Reduction in area after rupture, per cent of original section		43.3
Position of rupture		1".5 from neck
Character of broken surface		fine silky
Elongation of inch sections		".12, ".29*, ".09

SECOND HEAT.—STEEL AS RECEIVED.

No. 5652.

Marks, X—2.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000667	.000367	.....	.....	
6,000	30,000	.001033	.000366	.....	.....	
8,000	40,000	.001400	.000367	.....	.....	
10,000	50,000	.001733	.000333	0.	.....	
12,000	60,000	.002100	.000367	.....	.....	
13,000	65,000	.002300	.000200	.....	.....	
14,000	70,000	.002500	.000200	.000067	.000067	
14,200	71,000	.002533	.000033	.....	.....	
14,400	72,000	.002600	.000067	.....	.....	
14,600	73,000	.002667	.000067	.....	.....	Elastic limit.
14,800	74,000	.003833	.001166	.....	.....	
15,000	75,000	.006000	.002167	.....	.....	
15,200	76,000	.006500	.000500	.....	.....	
15,400	77,000	.007000	.000500	.....	.....	
15,600	78,000	.007667	.000667	.....	.....	
15,800	79,000	.008333	.000666	.....	.....	
16,000	80,000	.008933	.000600	.....	.....	
16,800	84,000	.0133	.004367	.....	.....	
17,600	88,000	.0167	.0034	.....	.....	
18,400	92,000	.0200	.0033	.....	.....	
19,200	96,000	.0233	.0033	.....	.....	
20,000	100,000	.0233+	.0000	.....	.....	
20,800	104,000	.0267	.0034	.....	.....	
21,600	108,000	.0300	.0033	.....	.....	
22,400	112,000	.0367	.0067	.....	.....	
23,200	116,000	.0433	.0066	.....	.....	
24,000	120,000	.0467	.0034	.....	.....	
24,800	124,000	.0600	.0133	.....	.....	
25,600	128,000	.0833	.0233	.....	.....	
25,800	129,000	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	129,000
Elastic limit per square inch of original section	do...	73,000
Elongation per inch after rupture	inch..	.1333
Elongation per inch under strain at elastic limit	do...	.002667
Reduction in diameter at point of rupture	do...	.055
Reduction in area after rupture, per cent of original section		20.5
Position of rupture		at middle of stem
Character of broken surface		fine granular, silky eccentric spot
Elongation of inch sections		″.10, ″.20*, ″.10

SECOND HEAT.—BARREL ROLLED AND ANNEALED IN CHARCOAL.

No. 5655.

Marks, X. 2. C.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.		
2,000	10,000	.000300	.000167			
4,000	20,000	.000667	.000367			
6,000	30,000	.001000	.000333			
8,000	40,000	.001333	.000333			
10,000	50,000	.001700	.000367	0.		
11,000	55,000	.001900	.000200			
12,000	60,000	.002100	.000200	.000033	.000033	Elastic limit.
12,200	61,000	.002233	.000133			
12,400	62,000	.004500	.002267			
12,600	63,000	.006000	.001500			
12,800	64,000	.006667	.000667			
13,000	65,000	.007467	.000800			
13,200	66,000	.008000	.000533			
13,400	67,000	.008667	.000667			
13,600	68,000	.009500	.000833			
14,400	72,000	.0133	.0038			
15,200	76,000	.0167	.0034			
16,000	80,000	.0200	.0033			
16,800	84,000	.0233	.0033			
17,600	88,000	.0267	.0034			
18,400	92,000	.0300	.0033			
19,200	96,000	.0333	.0033			
20,000	100,000	.0367	.0034			
20,800	104,000	.0433	.0066			
21,600	108,000	.0500	.0067			
22,400	112,000	.0633	.0133			
23,200	116,000	.0867	.0234			
23,290	116,450	.1033	.0166			Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	116,450
Elastic limit per square inch of original section	do...	60,000
Elongation per inch after rupture	inch..	.1300
Elongation per inch under strain at elastic limit	do...	.002100
Reduction in diameter at point of rupture	do...	.065
Reduction in area after rupture, per cent of original section		23.9
Position of rupture		".75 from neck
Character of broken surface		fine granular
Elongation of inch sections		".20", ".12, ".07

SAME AS X. 2 C TEST NO. 5655, BUT RAISED TO A DARK-RED HEAT AND THEN ALLOWED TO COOL.

No. 5672.

Marks, 70 X.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000667	.000367	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001333	.000333	.....	.....	
10,000	50,000	.001667	.000334	0.	.....	
12,000	60,000	.002033	.000366	.....	.....	
14,000	70,000	.002367	.000334	0.	.....	
14,200	71,000	.002400	.000033	.....	.....	
14,400	72,000	.002433	.000033	.....	.....	
14,600	73,000	.002467	.000034	.....	.....	
14,800	74,000	.002500	.000033	.....	.....	
15,000	75,000	.002533	.000033	.....	.....	
15,200	76,000	.002567	.000034	.....	.....	Elastic limit.
15,400	77,000	.003667	.001100	.....	.....	
						Load fell.
14,000	70,000	.004467	.000800	.....	.....	
14,200	71,000	.005500	.001033	.....	.....	
14,400	72,000	.007833	.002333	.....	.....	
15,200	76,000	.0133	.005467	.....	.....	
16,000	80,000	.0167	.0034	.....	.....	
16,800	84,000	.0200	.0033	.....	.....	
17,600	88,000	.0267	.0067	.....	.....	
18,400	92,000	.0300	.0033	.....	.....	
19,200	96,000	.0333	.0033	.....	.....	
20,000	100,000	.0367	.0034	.....	.....	
20,800	104,000	.0433	.0066	.....	.....	
21,600	108,000	.0533	.0100	.....	.....	
22,400	112,000	.0633	.0100	.....	.....	
23,200	116,000	.0833	.0200	.....	.....	
23,660	118,300	.1200	.0367	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	118,300
Elastic limit per square inch of original section	do...	76,000
Elongation per inch after rupture	inch..	.1767
Elongation per inch under strain at elastic limit	do...	.002567
Reduction in diameter at point of rupture	do...	.145
Reduction in area after rupture, per cent of original section		49.1
Position of rupture		1".1 from neck
Character of broken surface		fine silky, cup shaped
Elongation of inch sections		".08, ".17, ".28*

DUPLICATE OF No. 5672.

No. 5673.

Marks, 70 X.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 63″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000667	.000367	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001367	.000367	.....	.....	
10,000	50,000	.001700	.000333	.....	.....	
12,000	60,000	.002033	.000333	0.	.....	
14,000	70,000	.002367	.000334	0.	.....	
14,200	71,000	.002400	.000033	.....	.....	
14,400	72,000	.002467	.000067	.....	.....	
14,600	73,000	.002500	.000033	.....	.....	
14,800	74,000	.002567	.000067	.....	.....	
15,000	75,000	.002633	.000066	.....	.....	Elastic limit. Load fell.
13,800	69,000	.003833	.001200	.....	.....	
14,000	70,000	.004100	.000267	.....	.....	
14,200	71,000	.005333	.001233	.....	.....	
14,400	72,000	.009000	.003667	.....	.....	
15,200	76,000	.0133	.0043	.....	.....	
16,000	80,000	.0167	.0034	.....	.....	
16,800	84,000	.0200	.0033	.....	.....	
17,600	88,000	.0233	.0033	.....	.....	
18,400	92,000	.0300	.0067	.....	.....	
19,200	96,000	.0333	.0033	.....	.....	
20,000	100,000	.0367	.0034	.....	.....	
20,800	104,000	.0467	.0100	.....	.....	
21,600	108,000	.0533	.0066	.....	.....	
22,400	112,000	.0633	.0100	.....	.....	
23,200	116,000	.0967	.0334	.....	.....	
23,300	116,500	.1133	.0166	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	116,500
Elastic limit per square inch of original section	do...	75,000
Elongation per inch after rupture	inch..	.1800
Elongation per inch under strain at elastic limit	do...	.002633
Reduction in diameter at point of rupture	do...	.145
Reduction in area after rupture, per cent of original section		49.1
Position of rupture		1″.1 from neck
Character of broken surface		fine silky, cup-shaped
Elongation of inch sections		″.30*, ″.16, ″.08

SECOND HEAT.—BARREL ROLLED AND ANNEALED IN AIR.

No. 5656.

Marks, X 2 A.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000183	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000667	.000367	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001333	.000333	.....	.....	
10,000	50,000	.001700	.000367	0.	.....	
12,000	60,000	.002033	.000333	.....	.....	
13,000	65,000	.002200	.000167	.....	.....	
13,200	66,000	.002233	.000033	.....	.....	
13,400	67,000	.002300	.000067	.....	.....	
13,600	68,000	.002333	.000033	.....	.....	
13,800	69,000	.002367	.000034	.....	.....	
14,000	70,000	.002400	.000033	.....	.....	
14,200	71,000	.002467	.000067	.....	.....	
14,400	72,000	.002533	.000066	.....	.....	
14,600	73,000	.002567	.000034	.....	.....	Elastic limit.
14,800	74,000	.002667	.000100	.....	.....	
15,000	75,000	.005433	.002766	.....	.....	
15,200	76,000	.006067	.000634	.....	.....	
15,400	77,000	.006667	.000600	.....	.....	
15,600	78,000	.007233	.000566	.....	.....	
15,800	79,000	.007833	.000600	.....	.....	
16,000	80,000	.008500	.000667	.....	.....	
16,800	84,000	.0133	.0048	.....	.....	
17,600	88,000	.0167	.0034	.....	.....	
18,400	92,000	.0167+	.0000+	.....	.....	
19,200	96,000	.0200	.0033	.....	.....	
20,000	100,000	.0233	.0033	.....	.....	
20,800	104,000	.0267	.0034	.....	.....	
21,600	108,000	.0300	.0033	.....	.....	
22,400	112,000	.0333	.0033	.....	.....	
23,200	116,000	.0400	.0067	.....	.....	
24,000	120,000	.0467	.0067	.....	.....	
24,800	124,000	.0567	.0100	.....	.....	
25,600	128,000	.0700	.0133	.....	.....	
26,080	130,400	.1033	.0333	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	130,400
Elastic limit per square inch of original section	do...	73,000
Elongation per inch after rupture	inch..	.1200
Elongation per inch under strain at elastic limit	do...	.002567
Reduction in diameter at point of rupture	do...	.055
Reduction in area after rupture, per cent of original section		20.5
Position of rupture		1″.28 from neck
Character of broken surface		fine granular, radiating from a dull, silky spot near circumference
Elongation of inch sections		″.12, ″.16+, ″.08

THIRD HEAT.—STEEL AS RECEIVED.

No. 5657.

Marks, X 3.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads. Total.	Applied loads. Per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000333	.000200	.....	.....	
4,000	20,000	.000700	.000367	.....	.....	
6,000	30,000	.001033	.000333	.....	.....	
8,000	40,000	.001367	.000334	.....	.....	
10,000	50,000	.001733	.000366	0.	.....	
12,000	60,000	.002067	.000334	.....	.....	
13,600	68,000	.002333	.000266	.....	.....	
13,800	69,000	.002400	.000067	.....	.....	Elastic limit.
14,000	70,000	.002533	.000133	.000100	.000100	
14,200	71,000	.005333	.002800	.....	.....	
14,400	72,000	.006133	.000800	.....	.....	
14,600	73,000	.006767	.000634	.....	.....	
14,800	74,000	.007300	.000533	.....	.....	
15,000	75,000	.008000	.000700	.....	.....	
15,200	76,000	.008667	.000667	.....	.....	
16,000	80,000	.0133	.004633	.....	.....	
16,800	84,000	.0167	.0034	.....	.....	
17,600	88,000	.0200	.0033	.....	.....	
18,400	92,000	.0233	.0033	.....	.....	
19,200	96,000	.0267	.0034	.....	.....	
20,000	100,000	.0300	.0033	.....	.....	
20,800	104,000	.0333	.0033	.....	.....	
21,600	108,000	.0400	.0067	.....	.....	
22,400	112,000	.0467	.0067	.....	.....	
23,200	116,000	.0533	.0066	.....	.....	
24,000	120,000	.0700	.0167	.....	.....	
24,650	123,250	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	123,250
Elastic limit per square inch of original section	do...	69,000
Elongation per inch after rupture	inch..	.1667
Elongation per inch under strain at elastic limit	do...	.002400
Reduction in diameter at point of rupture	do...	.115
Reduction in area after rupture, per cent of original section		40.3
Position of rupture		1″.5 from neck
Character of broken surface		fine silky
Elongation of inch sections		″.10, ″.28*, ″.12

THIRD HEAT.—BARREL ROLLED AND ANNEALED IN CHARCOAL.

No. 5658.

Marks, X 3 C.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000633	.000333	.....	.....	
6,000	30,000	.000967	.000334	.....	.....	
8,000	40,000	.001300	.000333	.....	.....	
10,000	50,000	.001633	.000333	0.	.....	
11,000	55,000	.001833	.000200	.....	.....	
11,200	56,000	.001900	.000067	.....	.....	
11,400	57,000	.001933	.000033	.....	.....	Elastic limit.
11,600	58,000	.003833	.001900	.....	.....	
11,800	59,000	.005167	.001334	.....	.....	
12,000	60,000	.006100	.000933	.....	.....	
12,200	61,000	.006833	.000733	.....	.....	
12,400	62,000	.007333	.000500	.....	.....	
12,600	63,000	.008167	.000834	.....	.....	
12,800	64,000	.009000	.000833	.....	.....	
13,600	68,000	.0133	.0043	.....	.....	
14,400	72,000	.0167	.0034	.....	.....	
15,200	76,000	.0200	.0033	.....	.....	
16,000	80,000	.0233	.0033	.....	.....	
16,800	84,000	.0267	.0034	.....	.....	
17,600	88,000	.0300	.0033	.....	.....	
18,400	92,000	.0333	.0033	.....	.....	
19,200	96,000	.0400	.0067	.....	.....	
20,000	100,000	.0467	.0067	.....	.....	
20,800	104,000	.0567	.0100	.....	.....	
21,600	108,000	.0700	.0133	.....	.....	
22,360	111,800	.1167	.0467	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	111,800
Elastic limit per square inch of original section	do...	57,000
Elongation per inch after rupture	inch..	.1433
Elongation per inch under strain at elastic limit	do...	.001933
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		".80 from neck
Character of broken surface		fine granular, radiating from a point in the circumference
Elongation of inch sections		".11, ".15, ".27*

THIRD HEAT.—BARREL ROLLED AND ANNEALED IN AIR.

No. 5659.

Marks, X 3 A.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000333	.000200	.....	.....	
4,000	20,000	.000667	.000334	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001333	.000333	.....	.....	
10,000	50,000	.001700	.000367	0.	.....	
12,000	60,000	.002000	.000300	.....	.....	
13,000	65,000	.002233	.000233	.....	.....	
13,200	66,000	.002300	.000067	.....	.....	
13,400	67,000	.002367	.000067	.....	.....	
13,600	68,000	.002400	.000033	.....	.....	Elastic limit.
13,800	69,000	.002467	.000067	.....	.....	
14,000	70,000	.002583	.000066	.000133	.000133	
14,200	71,000	.002700	.000167	.....	.....	
14,400	72,000	.003000	.000300	.....	.....	
14,600	73,000	.003700	.000700	.....	.....	
14,800	74,000	.005000	.001300	.....	.....	
15,000	75,000	.005667	.000667	.....	.....	
15,200	76,000	.006333	.000666	.....	.....	
15,400	77,000	.008767	.002434	.....	.....	
15,600	78,000	.007333	.000566	.....	.....	
15,800	79,000	.008200	.000867	.....	.....	
16,000	80,000	.008833	.000633	.....	.....	
16,800	84,000	.0133	.004467	.....	.....	
17,600	88,000	.0167	.0034	.....	.....	
18,400	92,000	.0200	.0033	.....	.....	
19,200	96,000	.0233	.0033	.....	.....	
20,000	100,000	.0267	.0034	.....	.....	
20,800	104,000	.0300	.0033	.....	.....	
21,600	108,000	.0333	.0033	.....	.....	
22,400	112,000	.0367	.0034	.....	.....	
23,200	116,000	.0433	.0066	.....	.....	
24,000	120,000	.0533	.0100	.....	.....	
24,800	124,000	.0667	.0134	.....	.....	
25,310	126,550	.0967	.0300	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	126,550
Elastic limit per square inch of original section	do...	68,000
Elongation per inch after rupture	inch...	.1100
Elongation per inch under strain at elastic limit	do...	.002400
Reduction in diameter at point of rupture	do...	.035
Reduction in area after rupture, per cent of original section		13.2
Position of rupture		1".12 from neck
Character of broken surface		fine granular, radiating from center punch mark defining first inch section on bar.
Elongation of inch sections		".09, ".12*, ".12*

BESSEMER STEEL REDUCED TO BARS 1″.15 DIAMETER, INSTEAD OF 1″.4 DIAMETER, AS USUAL.

FROM 1″.15 BAR AS RECEIVED.

No. 5663.

Marks, 72.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000333	.000200	.....	.....	
4,000	20,000	.000667	.000334	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001333	.000333	.....	.....	
10,000	50,000	.001667	.000334	0.	.....	
12,000	60,000	.002033	.000366	.....	.....	
13,000	65,000	.002200	.000167	.....	.....	
14,000	70,000	.002400	.000200	.000033	.000033	
14,200	71,000	.002433	.000033	.....	.....	
14,400	72,000	.002467	.000034	.....	.....	
14,600	73,000	.002500	.000033	.....	.....	
14,800	74,000	.002567	.000067	.....	.....	
15,000	75,000	.002633	000066	.....	.....	Elastic limit.
15,200	76,000	.003067	.000434	.....	.....	
15,400	77,000	.008667	.005600	.....	.....	
15,600	78,000	.009333	.000666	.....	.....	
15,800	79,000	.009967	.000634	.....	.....	
16,800	84,000	.0167	.006733	.....	.....	
17,600	88,000	.0200	.0033	.....	.....	
18,400	92,000	.0233	.0033	.....	.....	
19,200	96,000	.0267	.0034	.....	.....	
20,000	100,000	.0300	.0033	.....	.....	
20,800	104,000	.0333	.0033	.....	.....	
21,600	108,000	.0400	.0067	.....	.....	
22,400	112,000	.0467	.0067	.....	.....	
23,200	116,000	.0533	.0066	.....	.....	
24,000	120,000	.0700	.0167	.....	.....	
24,490	122,450	.1033	.0333	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	122,450
Elastic limit per square inch of original section	do...	75,000
Elongation per inch after rupture	inch...	.1867
Elongation per inch under strain at elastic limit	do...	.002633
Reduction in diameter at point of rupture	do...	.145
Reduction in area after rupture, per cent of original section		49.1
Position of rupture		1″.66 from neck
Character of broken surface		fine silky, cup shaped
Elongation of inch sections		″.12, ″.33*, ″.11

From Rolled Barrel Annealed in Air.

No. 5664.

Marks, 72 A.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000633	.000333	.....	.....	
6,000	30,000	.000967	.000334	.....	.....	
8,000	40,000	.001300	.000333	.....	.....	
10,000	50,000	.001667	.000367	.000033	.000033	
12,000	60,000	.002000	.000333	.000033	0.	
13,000	65,000	.002267	.000267	.000100	.000067	Elastic limit.
13,200	66,000	.002367	.000100	.....	.....	
13,400	67,000	.002467	.000100	.....	.....	
13,600	68,000	.002567	.000100	.....	.....	
13,800	69,000	.002733	.000166	.....	.....	
14,000	70,000	.002933	.000200	.....	.....	
14,200	71,000	.003267	.000334	.....	.....	
14,400	72,000	.003600	.000333	.....	.....	
14,600	73,000	.003933	.000333	.....	.....	
14,800	74,000	.004333	.000400	.....	.....	
15,000	75,000	.004667	.000334	.....	.....	
15,200	76,000	.005167	.000500	.....	.....	
15,400	77,000	.005767	.000600	.....	.....	
15,600	78,000	.006167	.000400	.....	.....	
15,800	79,000	.006933	.000766	.....	.....	
16,000	80,000	.007467	.000534	.....	.....	
16,200	81,000	.008300	.000833	.....	.....	
16,400	82,000	.008833	.000533	.....	.....	
16,600	83,000	.009500	.000667	.....	.....	
17,600	88,000	.0133	.0038	.....	.....	
18,400	92,000	.0167	.0034	.....	.....	
19,200	96,000	.0200	.0033	.....	.....	
20,000	100,000	.0233	.0033	.....	.....	
20,800	104,000	.0300	.0067	.....	.....	
21,600	108,000	.0333	.0033	.....	.....	
22,400	112,000	.0367	.0034	.....	.....	
23,200	116,000	.0433	.0066	.....	.....	
24,000	120,000	.0533	.0100	.....	.....	
24,800	124,000	.0700	.0167	.....	.....	
25,210	126,050	.0933	.0233	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	126,050
Elastic limit per square inch of original section	do...	65,000
Elongation per inch after rupture	inch..	.1200
Elongation per inch under strain at elastic limit	do...	.002267
Reduction in diameter at point of rupture	do...	.035
Reduction in area after rupture, per cent of original section		13.2
Position of rupture		at middle of stem
Character of broken surface		fine granular
Elongation of inch sections		".11, ".17*, ".08

From Rolled Barrel Annealed in Charcoal.

No. 5665.

Marks, 72 C.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000633	.000333	.....	.....	
6,000	30,000	.000967	.000334	.....	.....	
8,000	40,000	.001300	.000333	.....	.....	
10,000	50,000	.001667	.000367	0.	.....	
11,000	55,000	.001867	.000200	.....	.....	Elastic limit.
11,200	56,000	.002000	.000133	.....	.....	
		.006233	.004233	.....	.....	
11,400	57,000	.007367	.001134	.....	.....	
11,600	58,000	.008167	.000800	.....	.....	
11,800	59,000	.009000	.000833	.....	.....	
12,000	60,000	.009500	.000500	.....	.....	
12,800	64,000	.0167	.0072	.....	.....	
13,600	68,000	.0167+	.0000+	.....	.....	
14,400	72,000	.0200	.0033	.....	.....	
15,200	76,000	.0233	.0033	.....	.....	
16,000	80,000	.0300	.0067	.....	.....	
16,800	84,000	.0333	.0033	.....	.....	
17,600	88,000	.0400	.0067	.....	.....	
18,400	92,000	.0467	.0067	.....	.....	
19,200	96,000	.0567	.0100	.....	.....	
20,000	100,000	.0700	.0133	.....	.....	
20,640	103,200	.1133	.0433	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	103,200
Elastic limit per square inch of original section	do...	55,000
Elongation per inch after rupture	inch..	.1767
Elongation per inch under strain at elastic limit	do...	.001867
Reduction in diameter at point of rupture	do...	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		1″ from neck
Character of broken surface		silky, trace of granulation
Elongation of inch sections		″.10, ″.16, ″.27*

SAME AS NO. 72, BUT ROLLED TO 1″.09 DIAMETER.

No. 5688.

Marks, 73.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	.0	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000633	.000333	.....	.....	
6,000	30,000	.000967	.000334	.....	.....	
8,000	40,000	.001333	.000366	.....	.....	
10,000	50,000	.001667	.000334	0.	.....	
12,000	60,000	.002000	.000333	.....	.....	
14,000	70,000	.002400	.000400	.....	.....	
15,000	75,000	.002600	.000200	.000033	.000033	
15,200	76,000	.002633	.000033	.....	.....	
15,400	77,000	.002667	.000034	.....	.....	
15,600	78,000	.002733	.000066	.....	.....	Elastic limit.
15,800	79,000	.002867	.000134	.....	.....	
16,000	80,000	.002933	.000066	.....	.....	
16,200	81,000	.003000	.000067	.000233	.000200	
16,400	82,000	.003333	.000333	.....	.....	
16,600	83,000	.004100	.000767	.....	.....	
16,800	84,000	.005233	.001133	.....	.....	
17,000	85,000	.005833	.000600	.....	.....	
17,200	86,000	.006467	.000634	.....	.....	
17,400	87,000	.006933	.000466	.....	.....	
17,600	88,000	.007667	.000734	.....	.....	
17,800	89,000	.008167	.000500	.....	.....	
18,000	90,000	.009000	.000833	.005367	.005134	
6,000	30,000	.006433	.....	.....	.....	
12,000	60,000	.007533	.....	.....	.....	
18,000	90,000	.009333	.....	.....	.....	
12,000	60,000	.008233	.....	.....	.....	
6,000	30,000	.007033	.....	.005800	.000433	
6,000	30,000	.006833	.....	.....	.....	
12,000	60,000	.008000	.....	.....	.....	
18,000	90,000	.009500	.....	.006000	.000200	
19,200	96,000	.0133	.0043	.....	.....	
20,000	100,000	.0167	.0034	.....	.....	
20,800	104,000	.0200	.0033	.....	.....	
21,600	108,000	.0233	.0033	.....	.....	
22,400	112,000	.0267	.0034	.....	.....	
23,200	116,000	.0300	.0033	.....	.....	
24,000	120,000	.0333	.0033	.....	.....	
24,800	124,000	.0400	.0067	.....	.....	
25,600	128,000	.0467	.0067	.....	.....	
26,400	132,000	.0567	.0100	.....	.....	
27,200	136,000	.0767	.0200	.....	.....	
27,310	136,550	.1033	.0266	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	136,550
Elastic limit per square inch of original section	do...	78,000
Elongation per inch after rupture	inch..	.1600
Elongation per inch under strain at elastic limit	do...	.002733
Reduction in diameter at point of rupture	do...	.125
Reduction in area after rupture, per cent of original section		43.3
Position of rupture		1″.3 from neck
Character of broken surface		fine silky, cup-shaped
Elongation of inch sections		″.10, ″.25*, ″.13

No. 73 "Box Annealed."

No. 5689.

Marks, 74.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000667	.000367	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001367	.000367	.....	.....	
10,000	50,000	.001700	.000333	0.	.....	
12,000	60,000	.002033	.000333	.....	.....	
14,000	70,000	.002400	.000367	0.	.....	
15,400	77,000	.002667	.000267	.....	.....	Elastic limit.
15,600	78,000	.003167	.000500	.....	.....	
						Load fell.
14,800	74,000	.004133	.000966	.....	.....	
15,000	75,000	.005167	.001034	.....	.....	
15,200	76,000	.007167	.002000	.....	.....	
15,400	77,000	.007833	.000666	.....	.....	
15,600	78,000	.008567	.000734	.....	.....	
15,800	79,000	.009300	.000733	.....	.....	
16,000	80,000	.010167	.000867	.006833	.000833	
16,800	84,000	.0133	.003133	.....	.....	
17,600	88,000	.0167	.0034	.....	.....	
18,400	92,000	.0200	.0033	.....	.....	
19,200	96,000	.0233	.0033	.....	.....	
20,000	100,000	.0267	.0034	.....	.....	
20,800	104,000	.0300	.0033	.....	.....	
21,600	108,000	.0367	.0067	.....	.....	
22,400	112,000	.0433	.0066	.....	.....	
23,200	116,000	.0500	.0067	.....	.....	
24,000	120,000	.0667	.0167	.....	.....	
24,620	123,100	.1067	.0400	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	123,100
Elastic limit per square inch of original section	do...	77,000
Elongation per inch after rupture	inch..	.1700
Elongation per inch under strain at elastic limit	do...	.002667
Reduction in diameter at point of rupture	do...	.125
Reduction in area after rupture, per cent of original section		43.3
Position of rupture		1".4 from neck
Character of broken rupture		fine silky
Elongation of inch sections		".12, ".30*, ".09

BARREL ROLLED AND COOLED IN AIR.

No. 5677.

Marks, 8 A.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000633	.000333	.....	.....	
6,000	30,000	.001000	.000367	.....	.....	
8,000	40,000	.001333	.000333	.....	.....	
10,000	50,000	.001700	.000367	0.	.....	
12,000	60,000	.002067	.000367	.....	.....	
13,000	65,000	.002233	.000166	.....	.....	
14,000	70,000	.002467	.000234	.000067	.000067	
14,200	71,000	.002533	.000066	.....	.....	Elastic limit.
14,400	72,000	.002667	.000134	.....	.....	
14,600	73,000	.004667	.002000	.....	.....	
14,800	74,000	.005900	.001233	.....	.....	
15,000	75,000	.006300	.000400	.....	.....	
15,200	76,000	.006867	.000567	.....	.....	
15,400	77,000	.007667	.000800	.....	.....	
15,600	78,000	.008333	.000666	.....	.....	
15,800	79,000	.008833	.000500	.....	.....	
16,000	80,000	.009333	.000500	.....	.....	
16,800	84,000	.0133	.003967	.....	.....	
17,000	88,000	.0167	.0034	.....	.....	
18,400	92,000	.0167+	.0000+	.....	.....	
19,200	96,000	.0200	.0033	.....	.....	
20,000	100,000	.0233	.0033	.....	.....	
20,800	104,000	.0267	.0034	.....	.....	
21,600	108,000	.0300	.0033	.....	.....	
22,400	112,000	.0367	.0067	.....	.....	
23,200	116,000	.0433	.0066	.....	.....	
24,000	120,000	.0500	.0067	.....	.....	
24,800	124,000	.0633	.0133	.....	.....	
25,440	127,200	.1100	.0467	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	127,200
Elastic limit per square inch of original section	do...	71,000
Elongation per inch after rupture	inch..	.1533
Elongation per inch under strain at elastic limit	do...	.002533
Reduction in diameter at point of rupture	do...	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		1".25 from neck
Character of broken surface		silky, interspersed with fine granulation
Elongation of inch sections		".16, ".21*, ".09

DUPLICATE OF No. 5677.

No. 5678.

Marks, 8 A.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000300	.000200	.....	.....	
4,000	20,000	.000633	.000333	.....	.....	
6,000	30,000	.000967	.000334	.....	.....	
8,000	40,000	.001333	.000366	.....	.....	
10,000	50,000	.001667	.000334	0.	.....	
12,000	60,000	.002000	.000333	.....	.....	
13,000	65,000	.002167	.000167	.....	.....	
14,000	70,000	.002400	.000233	.000033	.000033	
14,200	71,000	.002433	.000033	.....	.....	
14,400	72,000	.002467	.000034	.....	.....	Elastic limit.
14,600	73,000	.002533	.000066	.....	.....	
14,800	74,000	.002700	.000167	.....	.....	
15,000	75,000	.006667	.003967	.....	.....	
15,200	76,000	.007333	.000666	.....	.....	
15,400	77,000	.007667	.000334	.....	.....	
15,600	78,000	.008400	.000733	.....	.....	
15,800	79,000	.008867	.000467	.....	.....	
16,000	80,000	.009567	.000700	.....	.....	
16,800	84,000	.0133	.003733	.....	.....	
17,600	88,000	.0167	.0034	.....	.....	
18,400	92,000	.0200	.0033	.....	.....	
19,200	96,000	.0200+	.0000+	.....	.....	
20,000	100,000	.0233	.0033	.....	.....	
20,800	104,000	.0267	.0034	.....	.....	
21,600	108,000	.0333	.0066	.....	.....	
22,400	112,000	.0367	.0034	.....	.....	
23,200	116,000	.0433	.0066	.....	.....	
24,000	120,000	.0500	.0067	.....	.....	
24,800	124,000	.0633	.0133	.....	.....	
25,510	127,550	.1000	.0367	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	127,550
Elastic limit per square inch of original section	do...	72,000
Elongation per inch after rupture	inch..	.1533
Elongation per inch under strain at elastic limit	do...	.002467
Reduction in diameter at point of rupture	do...	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		1″.4 from neck
Character of broken surface		silky, interspersed with fine granulation
Elongation of inch sections		″.13, ″.25*, ″.08

BARREL ROLLED, COOLED IN AIR, REHEATED IN BARREL FURNACE, AND COOLED IN AIR.

No. 5679.

Marks, 8 B.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000667	.000367	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001333	.000333	.....	.....	
10,000	50.000	.001700	.000367	0.	.....	
11,800	59,000	.002033	.000333	.....	.....	Elastic limit.
12,000	60,000	.002167	.000134	.000100	.000100	
12,200	61,000	.002367	.000200	.....	.....	
12,400	62,000	.005500	.003133	.....	.....	
12,600	63,000	.006500	.001000	.....	.....	
12,800	64,000	.007433	.000933	.....	.....	
13,000	65,000	.008567	.001134	.....	.....	
13,200	66,000	.009600	.001033	.....	.....	
14,400	72,000	.0133	.0037	.....	.....	
15,200	76,000	.0167	.0034	.....	.....	
16,000	80,000	.0200	.0033	.....	.....	
16,800	84,000	.0233	.0033	.....	.....	
17,600	88,000	.0300	.0067	.....	.....	
18,400	92,000	.0367	.0067	.....	.....	
19,200	96,000	.0433	.0066	.....	.....	
20,000	100,000	.0500	.0067	.....	.....	
20,800	104,000	.0667	.0167	.....	.....	
21,600	108,000	.0900	.0233	.....	.....	
21,760	108,800	.1200	.0300	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	108,800
Elastic limit per square inch of original section	do...	59,000
Elongation per inch after rupture	inch..	.1933
Elongation per inch under strain at elastic limit	do...	.002033
Reduction in diameter at point of rupture	do...	.145
Reduction in area after rupture, per cent of original section		49.1
Position of rupture		at middle of stem
Character of broken surface		fine silky, cup-shaped
Elongation of inch sections		″.12, ″.36*, ″.10

DUPLICATE OF NO. 5679.

No. 5680.

Marks, 8 B.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000300	.000200	.....	.....	
4,000	20,000	.000667	.000367	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001333	.000333	.....	.....	
10,000	50,000	.001700	.000367	0.	.....	
11,000	55,000	.001867	.000167	.....	.....	
12,000	60,000	.002067	.000200	0.	.....	
13,000	65,000	.002333	.000166	.....	.....	
13,200	66,000	.002300	.000067	.....	.....	
13,400	67,000	.002333	.000033	.....	.....	
13,600	68,000	.002367	.000034	.....	.....	
13,800	69,000	.002400	.000033	.....	.....	
14,000	70,000	.002467	.000067	.....	.....	Elastic limit.
14,200	71,000	.002567	.000100	.....	.....	
14,400	72,000	.004333	.001766	.....	.....	
14,600	73,000	.005167	.000834	.....	.....	
14,800	74,000	.006000	.000833	.....	.....	
15,000	75,000	.007667	.001667	.....	.....	
15,200	76,000	.010667	.003000	.....	.....	
16,000	80,000	.0133	.002633	.....	.....	
16,800	84,000	.0167	.0034	.....	.....	
17,600	88,000	.0200	.0033	.....	.....	
18,400	92,000	.0233	.0033	.....	.....	
19,200	96,000	.0300	.0067	.....	.....	
20,000	100,000	.0367	.0067	.....	.....	
20,800	104,000	.0400	.0033	.....	.....	
21,600	108,000	.0500	.0100	.....	.....	
22,400	112,000	.0600	.0100	.....	.....	
23,200	116,000	.0733	.0133	.....	.....	
23,810	119,050	.1133	.0400	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	119,050
Elastic limit per square inch of original section	do...	70,000
Elongation per inch after rupture	inch..	.1900
Elongation per inch under strain at elastic limit	do..	.002467
Reduction in diameter at point of rupture	do...	.155
Reduction in area after rupture, per cent of original section		51.9
Position of rupture		1″ from neck
Character of broken surface		fine silky, cup-shaped
Elongation of inch sections		″.32*, ″.15, ″.10

BARREL ROLLED, COOLED IN AIR, 12″ AT BUTT END REHEATED IN CHARCOAL FIRE AND COOLED IN AIR.

No. 5681.

Marks, 8 C.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000667	.000367	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001333	.000333	.....	.....	
10,000	50,000	.001700	.000367	.....	.....	
12,000	60,000	.002033	.000333	.....	.....	
13,000	65,000	.002233	.000200	.000033	.000033	Elastic limit.
13,200	66,000	.002367	.000134	.....	.....	
						Load fell.
12,800	64,000	.003167	.000800	.....	.....	
13,000	65,000	.004000	.000833	.....	.....	
13,200	66,000	.006800	.002800	.....	.....	
13,400	67,000	.007500	.000900	.....	.....	
13,600	68,000	.008000	.000500	.....	.....	
13,800	69,000	.008767	.000767	.....	.....	
14,000	70,000	.009500	.000733	.....	.....	
14,400	72,000	.0133	.0038	.....	.....	
15,200	76,000	.0167	.0034	.....	.....	
16,000	80,000	.0200	.0033	.....	.....	
16,800	84,000	.0233	.0033	.....	.....	
17,600	88,000	.0267	.0034	.....	.....	
18,400	92,000	.0300	.0033	.....	.....	
19,200	96,000	.0333	.0033	.....	.....	
20,000	100,000	.0400	.0067	.....	.....	
20,800	104,000	.0467	.0067	.....	.....	
21,600	108,000	.0567	.0100	.....	.....	
22,400	112,000	.0733	.0166	.....	.....	
22,890	114,450	.1100	.0367	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	114,450
Elastic limit per square inch of original section	do...	65,000
Elongation per inch after rupture	inch..	.1767
Elongation per inch under strain at elastic limit	do...	.002233
Reduction in diameter at point of rupture	do...	.145
Reduction in area after rupture, per cent of original section		49.1
Position of rupture		1″.45 from neck
Character of broken surface		fine silky, cup shaped
Elongation of inch sections		″.10, ″.31+, ″.12

DUPLICATE OF No. 5681.

No. 5682.

Marks, 8 C.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permament set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000300	.000200	.....	.....	
4,000	20,000	.000633	.000333	.....	.....	
6,000	30,000	.000967	.000334	.....	.....	
8,000	40,000	.001333	.000366	.....	.....	
10,000	50,000	.001667	.000334	0.	.....	
12,000	60,000	.002000	.000333	.....	.....	
13,000	65,000	.002167	.000167	0.	.....	
13,200	66,000	.002200	.000033	.....	.....	
13,400	67,000	.002233	.000033	.....	.....	
13,600	68,000	.002267	.000034	.....	.....	
13,800	69,000	.002300	.000033	.....	.....	
14,000	70,000	.002333	.000033	.....	.....	
14,200	71,000	.002367	.000034	.....	.....	Elastic limit.
14,400	72,000	.002433	.000066	.....	.....	
						Load fell.
13,800	69,000	.004533	.002100	.....	.....	
14,000	70,000	.005833	.001300	.....	.....	
14,200	71,000	.008600	.002767	.....	.....	
14,400	72,000	.009167	.000567	.....	.....	
14,600	73,000	.009833	.000666	.....	.....	
15,200	76,000	.0133	.003467	.....	.....	
16,000	80,000	.0167	.0034	.....	.....	
16,800	84,000	.0167+	.0000+	.....	.....	
17,600	88,000	.0233	.0066	.....	.....	
18,400	92,000	.0267	.0034	.....	.....	
19,200	96,000	.0300	.0033	.....	.....	
20,000	100,000	.0333	.0033	.....	.....	
20,800	104,000	.0400	.0067	.....	.....	
21,600	108,000	.0467	.0067	.....	.....	
22,400	112,000	.0567	.0100	.....	.....	
23,200	116,000	.0700	.0133	.....	.....	
23,780	118,900	.1233	.0533	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	118,900
Elastic limit per square inch of original section	do...	71,000
Elongation per inch after rupture	inch..	.1700
Elogation per inch under strain at elastic limit	do...	.002367
Reduction in diameter at point of rupture	do...	.125
Reduction in area after rupture, per cent of original section		43.3
Position of rupture		".75 from neck
Character of broken surface		fine silky, trace of granulation
Elongation of inch sections		".31*, ".12, ".08

BARREL ROLLED, COOLED IN AIR, 12″ AT BUTT END REHEATED IN GASOLINE FURNACE AND COOLED IN AIR.

No. 5683.

Marks, 8 G.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000333	.000200	.....	.....	
4,000	20,000	.000667	.000334	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001333	.000333	.....	.....	
10,000	50,000	.001700	.000367	0.	.....	
11,000	55,000	.001867	.000167	.....	.....	
12,000	60,000	.002033	.000166	0.	.....	
12,200	61,000	.002067	.000034	.....	.....	
12,400	62,000	.002133	.000066	.....	.....	
12,600	63,000	.002167	.000034	.....	.....	
12,800	64,000	.002200	.000033	.....	.....	
13,000	65,000	.002233	.000033	.....	.....	Elastic limit.
13,200	66,000	.002300 .003233	.000067 .000933	.....	.....	
13,400	67,000	.003900	.000667	.....	.....	
13,600	68,000	.004400	.000500	.....	.....	
13,800	69,000	.006000	.001600	.....	.....	
14,000	70,000	.007167	.001167	.....	.....	
14,200	71,000	.008933	.001766	.....	.....	
14,400	72,000	.009600	.000667	.....	.....	
15,200	76,000	.0133	.0037	.....	.....	
16,000	80,000	.0167	.0034	.....	.....	
16,800	84,000	.0167+	.0000+	.....	.....	
17,600	88,000	.0200	.0033	.....	.....	
18,400	92,000	.0233	.0033	.....	.....	
19,200	96,000	.0300	.0067	.....	.....	
20,000	100,000	.0333	.0033	.....	.....	
20,800	104,000	.0367	.0034	.....	.....	
21,600	108,000	.0433	.0066	.....	.....	
22,400	112,000	.0533	.0100	.....	.....	
23,200	116,000	.0667	.0134	.....	.....	
23,680	118,400	.1000	.0333	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	118,400
Elastic limit per square inch of original section	do...	65,000
Elongation per inch after rupture	inch..	.1467
Elongation per inch under strain at elastic limit	do...	.002233
Reduction in diameter at point of rupture	do...	.135
Reduction in area after rupture, per cent of original section		46.2
Position of rupture		″.56 from neck
Character of broken surface		fine silky, trace of granulation
Elongation of inch sections		″.07, ″.08, ″.29*

DUPLICATE OF No. 5683.

No. 5684.

Marks, 8 G.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000633	.000333	.....	.....	
6,000	30,000	.001000	.000367	.....	.....	
8,000	40,000	.001333	.000333	.....	.....	
10,000	50,000	.001700	.000367	0.	.....	
11,000	55,000	.001867	.000167	.....	.....	
12,000	60,000	.002033	.000166	0.	.....	
12,200	61,000	.002067	.000034	.....	.....	
12,400	62,000	.002100	.000033	.....	.....	
12,600	63,000	.002133	.000033	.....	.....	
12,800	64,000	.002167	.000034	.....	.....	
13,000	65,000	.002233	.000066	.....	.....	
13,200	66,000	.002267	.000034	.....	.....	
13,400	67,000	.002300	.000033	.....	.....	
13,600	68,000	.002333	.000033	.....	.....	
13,800	69,000	.002367	.000034	.....	.....	
14,000	70,000	.002433	.000066	0.	.....	Elastic limit.
14,200	71,000	.004333	.001900	.....	.....	
14,400	72,000	.006833	.002500	.....	.....	
14,600	73,000	.007600	.000767	.....	.....	
14,800	74,000	.008333	.000733	.....	.....	
15,000	75,000	.009000	.000667	.....	.....	
15,200	76,000	.009667	.000667	.....	.....	
16,000	80,000	.0100	.000333	.....	.....	
16,800	84,000	.0133	.0033	.....	.....	
17,600	88,000	.0167	.0034	.....	.....	
18,400	92,000	.0200	.0033	.....	.....	
19,200	96,000	.0233	.0033	.....	.....	
20,000	100,000	.0267	.0034	.....	.....	
20,800	104,000	.0333	.0066	.....	.....	
21,600	108,000	.0367	.0034	.....	.....	
22,400	112,000	.0433	.0066	.....	.....	
23,200	116,000	.0533	.0100	.....	.....	
24,000	120,000	.0667	.0134	.....	.....	
24,770	123,850	.1000	.0333	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	123,850
Elastic limit per square inch of original section	do...	70,000
Elongation per inch after rupture	inch..	.1500
Elongation per inch under strain at elastic limit	do...	.002433
Reduction in diameter at point of rupture	do...	.115
Reduction in area after rupture, per cent of original section		40.3
Position of rupture		".8 from neck
Character of broken surface		fine silky, trace of granulation
Elongation of inch sections		".27", ".11, ".07

No. 5719.

Marks, 75.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000067	.000067	0.	.....	
2,000	10,000	.000300	.000233	.....	.....	
4,000	20,000	.000633	.000333	.....	.....	
6,000	30,000	.000967	.000334	.....	.....	
8,000	40,000	.001300	.000333	.....	.....	
10,000	50,000	.001667	.000367	0.	.....	
12,000	60,000	.001967	.000300	.....	.....	
14,000	70,000	.002333	.000366	0.	.....	
15,000	75,000	.002500	.000167	.....	.....	
15,200	76,000	.002533	.000033	.....	.....	
15,400	77,000	.002600	.000067	.....	.....	Elastic limit. Load fell.
14,600	73,000	.005267	.002667	.....	.....	
14,800	74,000	.009667	.004400	.....	.....	
15,000	75,000	.010000	.000333	.....	.....	
15,200	76,000	.010333	.000333	.....	.....	
15,400	77,000	.010677	.000334	.....	.....	
15,600	78,000	.011333	.000666	.....	.....	
15,800	79,000	.012267	.000934	.....	.....	
16,000	80,000	.013067	.000800	.....	.....	
16,400	82,000	.014500	.001433	.....	.....	
16,800	84,000	.015967	.001467	.....	.....	
17,200	86,000	.017500	.001533	.....	.....	
17,600	88,000	.019000	.001500	.....	.....	
18,000	90,000	.021000	.002000	.....	.....	
18,800	94,000	.024000	.003000	.....	.....	
19,600	98,000	.028667	.004667	.....	.....	
20,400	102,000	.037033	.008366	.....	.....	
21,200	106,000	.038000	.000967	.....	.....	
22,000	110,000	.045667	.007667	.....	.....	
22,800	114,000	.055833	.010166	.....	.....	
23,600	118,000	.073333	.017500	.....	.....	
23,980	119,900	.108333	.035000	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	119,900
Elastic limit per square inch of original section	do...	77,000
Elongation per inch after rupture	inch..	.1700
Elongation per inch under strain at elastic limit	do...	.002600
Reduction in diameter at point of rupture	do...	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		1″.20 from neck
Character of broken surface		fine silky, dark gray; cup shaped
Elongation of inch sections		″.20*, ″.20*, ″.11

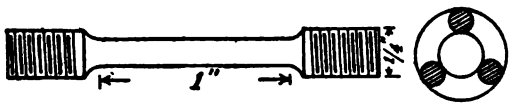
TABULATION OF TENSION SPECIMENS FROM RIFLE-BARREL STEEL (LENGTH OF STEMS).

No. of test.	Mark on specimen.	Diameter.	Sectional area.	Elastic limit per sq. inch.	Tensile strength per sq. inch.	Elongation in 8 inches.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.	Remarks.
		Inch.	*Sq. in.*	*Pounds.*	*Pounds.*	*Per ct.*	*Per ct.*		" " "	
5537	49.....	.505	.20	67,000	120,600	17.0	40.3	Fine silky, trace of granulation.....	.10, .26*, .15	Stock for barrels.
5538	49 A.....	.505	.20	57,000	98,600	18.7	30.7	Fine silky 40 per cent, granular 60 per cent.	.14, .24*, .18	From forged barrel.
5580	49.....	.564	.25	59,000	106,680	16.0	27.6	Fine granular, radiating from a spot near the center.	.21*, .16, .11	Breech end.
5581	49.....	.505	.20	62,000	107,050	16.7	34.0	Silky, interspersed with fine granulation	.25*, .15, .10	Muzzle end. } From rolled barrel.
5547	49 A-M....	.505	.20	58,000	107,550	18.7	37.1	Silky, with trace of granulation.....	.13, .21*, .22	Muzzle end.
5548	49 A-B	.505	.20	57,000	106,350	17.7	37.1	.....do	.27*, .16, .10	Breech end. } From barrel that had been rolled, cooled in air, reheated in coal furnace, and annealed in charcoal.
5539	60.....	.505	.20	77,000	121,950	16.7	43.8	Very fine silky.....	.11, .28*, .11	Bar 1".05 diameter.
5540	61.....	.505	.20	73,000	106,800	23.7	49.1	.....do	.16, .40*, .15	New stock.
5541	61 A.....	.505	.20	60,000	102,550	21.3	37.1	Silky, interspersed with fine granulation	.14, .32*, .18	Forged barrel of new stock.
5542	62.....	.505	.20	79,000	139,900	15.3	37.1	Very fine silky, cup shaped.....	.10, .26*, .10	New sample, bar 1".4 diameter.
5543	63.....	.505	.20	71,000	122,050	17.3	40.3	Fine silky, trace of granulation, cup shaped.	.10, .29*, .13	New sample, bar 1".15 diameter.
5544	64.....	.505	.20	83,000	137,550	14.0	34.0	Fine silky, interspersed with fine granulation, cup shaped.	.08, .12, .22*	Do.
5553	S	.564	.25	49,000	115,920	6.0	15.0	Fine granular	.04, .04, .10*	Sanderson's tool steel for heavy barrel.
5562	61-S	.564	.25	72,000	132,480	15.0	33.5	Silky, with fine granulation near circumference.	.10, .25*, .10	Special steel.
5575	65.....	.505	.20	67,000	97,100	21.3	46.2	Fine silky, cup shaped.....	.14, .36*, .14	Do.
5576	66.....	.505	.20	56,000	115,300	14.7	20.5	Fine granular	.12, .20*, .12	From special barrel.
5577	66.....	.505	.20	54,000	113,050	9.3	9.5	.....do	.09, .10*, .09*	Do.
5578	67.....	.564	.25	67,000	115,520	17.0	33.5	Silky, interspersed with fine granulation at the circumference.	.11, .27*, .13	
5579	67.....	.505	.20	68,000	116,100	17.7	37.1	Fine silky, with trace of granulation...	.11, .28*, .14	
5604	68-1.....	.505	.20	69,000	127,050	13.0	23.9	Fine granular, radiating from a silky spot at the center.	.09, .21*, .09	
5605	68-2.....	.505	.20	74,000	125,000	16.3	37.1	Silky, interspersed with fine granulation, cup shaped.	.11, .27*, .11	
5606	68-3.....	.505	.20	67,000	119,700	15.3	34.0	.....do	.10, .26*, .10	
5607	68-4.....	.505	.20	76,000	129,850	14.7	30.7	.....do	.15, .20*, .09	
5611	63 B	.505	.20	57,000	108,000	17.3	27.4	Silky, interspersed with fin granulation	.13, .26*, .13	Breech end. } From a rolled barrel which has been annealed in charcoal.
5612	63 M.....	.505	.20	64,000	112,000	17.0	37.1	Fine silky, cup shaped.....	.10, .15, .26*	Muzzle end. }
5613	68-5.....	.505	.20	74,000	124,500	15.3	34.0	Silky, interspersed with fine granulation	.19*, .18, .09	..... } From similar Bessemer steel.
5614	68-7.....	.505	.20	70,000	115,150	16.3	37.1	.....do	.19, .21*, .09	.....
5615	68-2c	.505	.20	66,000	117,900	13.3	23.9	Silky and fine granular metal interspersed.	.21*, .11, .08	Rolled barrel annealed in charcoal.
5616	68-2 A.....	.505	.20	71,000	127,700	16.3	37.1	Fine silky, trace of granulation, cup shaped.	.24*, .15, .10	Rolled barrel cooled in air....

5641	68-8	.505	.20	70,000	120,350	17.3	40.3	Fine silky, cup shaped	.11, .30*, .11		Bessemer steel.
5642	68-9	.505	.20	72,000	123,400	15.7	37.1	Silky, interspersed with fine granulation, cup shaped.	.09, .26*, .12		
5643	68-11	.505	.20	73,000	120,000	16.7	46.2	Fine silky, cup shaped	.10, .30*, .10		
5644	5-A	.505	.20	76,000	128,050	16.7	43.3	do	.16, .24*, .10	From barrel annealed in air.	
5645	5-C	.505	.20	69,000	119,550	15.7	34.0	Fine silky, dark gray	.25*, .12, .10	From barrel annealed in charcoal.	
5651	X-1	.505	.20	73,000	121,300	17.3	46.2	Fine silky	.30*, .13, .09	Steel as received	First heat.
5653	X-1-C	.505	.20	56,000	109,150	12.3	16.9	Fine granular	.16*, .12, .09	Barrel rolled and annealed in charcoal.	
5654	X-1-A	.505	.20	68,000	120,150	16.7	43.3	Fine silky	.12, .29*, .09	Barrel rolled and annealed in air.	
5652	X-2	.505	.20	73,000	129,000	13.3	20.5	Fine granular, silky eccentric spot	.10, .20*, .10	Steel as received	Second heat.
5655	X-2-C	.505	.20	60,000	116,450	13.0	23.9	Fine granular	.20*, .12, .07	Barrel rolled and annealed in charcoal.	
5672	70-X	.505	.20	76,000	118,300	17.7	49.1	Fine silky, cup shaped	.06, .17, .28*	Same as preceding specimen, but raised to a dark red heat and then allowed to cool.	
5673	70-X	.505	.20	75,000	116,500	18.0	49.1	do	.30*, .16, .06	Duplicate of No. 5672	
5656	X-2-A	.505	.20	73,000	130,400	12.0	20.5	Fine granular, radiating from dull silky spot near circumference.	.12, .16*, .08	Barrel rolled and annealed in air.	
5657	X-3	.505	.20	69,000	123,250	16.7	40.3	Fine silky	.10, .28*, .12	Steel as received	Third heat.
5658	X-3-C	.505	.20	57,000	111,800	14.3	16.9	Fine granular, radiating from a point in the circumference.	.11, .15, .27*	Barrel rolled and annealed in charcoal.	
5650	X-3-A	.505	.20	68,000	126,550	11.0	13.2	Fine granular, radiating from center punch mark defining first inch section on bar.	.09, .12*, .12*	Barrel rolled and annealed in air.	
5663	72	.505	.20	75,000	122,450	18.7	49.1	Fine silky, cup shaped	.12, .33*, .11	Bar as received	Bessemer steel. Reduced to bars 1".15 diameter instead of 1".4, as usual.
5664	72-A	.505	.20	65,000	126,050	12.0	13.2	Fine granular	.11, .17*, .08	From rolled barrel annealed in air.	
5665	72-C	.505	.20	55,000	103,200	17.7	37.1	Silky, trace of granulation	.10, .16, .27*	From rolled barrel annealed in charcoal.	
5688	73	.505	.20	78,000	136,550	16.0	43.3	Fine silky, cup shaped	.10, .25*, .13	Same as No. 72, but rolled to 1".09 diameter.	
5689	74	.505	.20	77,000	123,100	17.0	43.3	Fine silky	.12, .30*, .09	No. 73 box annealed.	
5677	8-A	.505	.20	71,000	127,200	15.3	37.1	Silky, interspersed with fine granulation	.16, .21*, .09	Barrels rolled and cooled in air.	
5678	8-A	.505	.20	72,000	127,550	15.3	37.1	do	.13, .25*, .08		
5679	8-B	.505	.20	59,000	108,800	19.3	49.1	Fine silky, cup shaped	.12, .36*, .10	Barrels rolled, cooled in air, reheated in barrel furnace, and cooled in air.	
5680	8-B	.505	.20	70,000	119,050	19.0	51.9	do	.32*, .15, .10		
5681	8-C	.505	.20	65,000	114,450	17.7	49.1	do	.10, .31*, .12	Barrels rolled, cooled in air, 12" at butt end reheated in charcoal fire and cooled in air.	
5682	8-C	.505	.20	71,000	118,900	17.0	43.3	Fine silky, trace of granulation	.31*, .12, .08		
5683	8-G	.505	.20	65,000	118,400	14.7	46.2	do	.07, .08, .29*	Barrels rolled, cooled in air, 12" at butt end reheated in gasolene furnace, and cooled in air.	
5684	8-G	.505	.20	70,000	123,850	15.0	40.3	do	.27*, .11, .07		
3719	75	.505	.20	77,000	119,900	17.0	37.1	Fine silky, dark gray, cup shaped	.20*, .20*, .11		

FOUR RIFLE BARRELS, CAL. .30, FROM SPRINGFIELD ARMORY.

Barrels are from the same steel as tested under the number 68–2, page 131.
The bright barrels are like 68–2c, page 138.
The barrels, which were heated a portion of their length, were raised to a red heat and allowed to cool.
Longitudinal specimens from breech end of barrels.



No. of test.	Barrel from whence taken.	Diameter.	Sectional area.	Elastic limit.		Tensile strength.		Elongation in 1 inch.	Area at fracture.	Contraction of area.	Appearance of fracture.
				Total.	Per square inch.	Total.	Per square inch.				
		Inch.	*Sq. inch.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Per ct.*	*In. Sq. in.*	*Per cent.*	
9132	Bright barrel 1	.1584	.0197	1,320	67,000	2,366	120,100	16	Diam..11=.0095	51.8	Silky.
9133	.....do	.1590	.0199	1,250	62,810	2,376	119,400	16	Diam..11=.0095	52.3	Do.
9134	.....do	.1594	.0199	1,340	67,340	2,370	119,100	16	Diam..12=.0113	43.2	Do.
9135	Bright barrel 2	.1590	.0199	1,210	60,800	2,287	114,920	16	Diam..12=.0113	43.2	Silky, trace of granulation.
9136	.....do	.1591	.0199	1,235	62,060	2,275	114,320	14	Diam..12=.0113	43.2	Do.
9137	.....do	.1598	.0200	1,248	62,400	2,293	114,650	14	Diam..13=.0133	33.5	Silky, granular metal interspersed.
9138	Heated barrel 1	.1595	.0200	1,510	75,500	2,414	120,700	21	Diam..11=.0095	52.5	Silky.
9139	.....do	.1600	.0201	1,390	69,150	2,411	119,950	19	Diam..11=.0095	52.7	Do.
9140	.....do	.1581	.0196	1,460	74,490	2,382	121,530	18	Diam..11=.0095	51.5	Do.
9141	Heated barrel 2	.1600	.0201	1,460	72,640	2,346	116,710	20	Diam..11=.0095	52.7	Do.
9142	.....do	.1593	.0199	1,280	64,320	2,265	113,820	19	Diam..11=.0095	52.3	Do.
9143	.....do	.1592	.0199	1,320	66,330	2,314	116,280	19	Diam..11=.0095	52.3	Do.

RECEIVERS OF RIFLES, .30 CALIBER.

NEW STOCK FOR RECEIVERS.

No. 5545.

Marks, 32 R.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	.....	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000633	.000333	.....	.....	
6,000	30,000	.000967	.000334	.....	.....	
8,000	40,000	.001333	.000366	.....	.....	
9,400	47,000	.001600	.000267	.....	.....	Elastic limit.
						Load fell.
8,800	44,000	.004333	.002733	.....	.....	
9,000	45,000	.009000	.004667	.....	.....	
9,200	46,000	.0133	.0043	.....	.....	
9,600	48,000	.0167	.0034	.....	.....	
10,000	50,000	.0167+	.0000+	.....	.....	
10,800	54,000	.0233	.0066	.....	.....	
11,600	58,000	.0300	.0067	.....	.....	
12,400	62,000	.0367	.0067	.....	.....	
13,200	66,000	.0467	.0100	.....	.....	
14,000	70,000	.0600	.0133	.....	.....	
14,800	74,000	.0767	.0167	.....	.....	
15,200	76,000	.0933	.0166	.....	.....	
15,600	78,000	.1200	.0267	.....	.....	
15,860	79,300	.1833	.0633	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	79,300
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.2267
Elongation per inch under strain at elastic limit	do...	.001600
Reduction in diameter at point of rupture	do...	.095
Reduction in area after rupture, per cent of original section		34.0
Position of rupture		at middle of stem
Character of broken surface		silky, oblique ends
Elongation of inch sections		".20, ".31", ".17

FORGED RECEIVER OF NEW STOCK.

No. 5546.

Marks, 32 R. F.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000333	.000200	.....	.....	
4,000	20,000	.000700	.000367	.....	.....	
6,000	30,000	.001033	.000333	.....	.....	
8,000	40,000	.001433	.000400	.000067	.000067	
8,600	43,000	.001533	.000100	.....	.....	Elastic limit.
8,800	44,000	.001667	.000134	.....	.....	
		.005500	.003833	.....	.....	
9,000	45,000	.005467	.000967	.....	.....	
9,200	46,000	.007500	.001033	.....	.....	
9,400	47,000	.008667	.001167	.....	.....	
9,600	48,000	.009667	.001000	.....	.....	
10,000	50,000	.0133	.003633	.....	.....	
10,800	54,000	.0167	.0034	.....	.....	
11,600	58,000	.0233	.0066	.....	.....	
12,400	62,000	.0300	.0067	.....	.....	
13,200	66,000	.0367	.0067	.....	.....	
14,000	70,000	.0467	.0100	.....	.....	
14,800	74,000	.0567	.0100	.....	.....	
15,600	78,000	.0733	.0166	.....	.....	
16,400	82,000	.1033	.0300	.....	.....	
16,890	84,450	.1733	.0700	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	84,450
Elastic limit per square inch of original section	do...	43,000
Elongation per inch after rupture	inch..	.2567
Elongation per inch under strain at elastic limit	do...	.001533
Reduction in diameter at point of rupture	do...	.145
Reduction in area after rupture, per cent of original section		49.1
Position of rupture		1".8 from neck
Character of broken surface		fine silky
Elongation of inch sections		".19, ".41*, ".17

GATLING GUNS.

STEEL FOR BARRELS.

No. 5697.

Marks, C_1.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000333	.000233	.....	.....	
4,000	20,000	.000700	.000367	.....	.....	
6,000	30,000	.001033	.000333	0.	.....	
8,000	40,000	.001367	.000334	.....	.....	
10,000	50,000	.001700	.000333	.....	.....	
12,000	60,000	.002033	.000333	0.	.....	
12,200	61,000	.002067	.000034	.....	.....	
12,400	62,000	.002100	.000033	.....	.....	Elastic limit.
12,600	63,000	.003100	.001000	.....	.....	
						Load fell.
11,400	57,000	.003633	.000533	.....	.....	
11,600	58,000	.004633	.001000	.....	.....	
11,800	59,000	.005667	.001034	.....	.....	
12,000	60,000	.006633	.001966	.....	.....	
12,200	61,000	.006967	.000334	.....	.....	
12,400	62,000	.009433	.000466	.....	.....	
12,600	63,000	.010067	.000634	.....	.....	
12,800	64,000	.010567	.000500	.....	.....	
13,200	66,000	.011333	.000766	.....	.....	
13,600	68,000	.013100	.001767	.....	.....	
14,000	70,000	.014333	.001233	.....	.....	
14,480	72,000	.015767	.001434	.....	.....	
15,200	76,000	.019167	.003400	.....	.....	
16,000	80,000	.022000	.002833	.....	.....	
16,800	84,000	.025667	.003667	.....	.....	
17,600	88,000	.029767	.004100	.....	.....	
18,400	92,000	.034000	.004233	.....	.....	
19,200	96,000	.0400	.0060	.....	.....	
20,000	100,000	.0467	.0067	.....	.....	
20,800	104,000	.0567	.0100	.....	.....	
21,600	108,000	.0733	.0166	.....	.....	
22,400	112,000	.1067	.0334	.....	.....	
22,460	112,300	.1200	.0133	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	112,300
Elastic limit per square inch of original section	do...	62,000
Elongation per inch after rupture	inch..	.1800
Elongation per inch under strain at elastic limit	do...	.002100
Reduction in diameter at point of rupture	do...	.085
Reduction in area after rupture, per cent of original section		30.7
Position of rupture		1″.4 from neck
Character of broken surface		silky, interspersed with fine granulation near the circumference
Elongation of inch sections		″.12, ″.27*, ″.15

No. 5698.

Marks, C 2.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000333	.000200	.....	.....	
4,000	20,000	.000667	.000334	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001367	.000367	.....	.....	
10,000	50,000	.001733	.000366	.000033	.000033	
11,000	55,000	.001867	.000134	.....	.....	
11,400	57,000	.001900	.000033	.....	.....	
11,600	58,000	.001967	.000067	.....	.....	
11,800	59,000	.002000	.000033	.....	.....	Elastic limit.
12,000	60,000	.002433	.000433	.....	.....	
12,200	61,000	.004333	.001900	.....	.....	
12,400	62,000	.005333	.001000	.....	.....	
12,600	63,000	.005700	.000367	.....	.....	
12,800	64,000	.006333	.000633	.....	.....	
13,000	65,000	.006733	.000400	.....	.....	
13,200	66,000	.007267	.000534	.....	.....	
13,600	68,000	.008333	.001066	.....	.....	
14,000	70,000	.009667	.001334	.....	.....	
14,400	72,000	.010833	.001166	.....	.....	
15,200	76,000	.013000	.002167	.....	.....	
16,000	80,000	.015667	.002667	.....	.....	
16,800	84,000	.018333	.002666	.....	.....	
17,600	88,000	.021167	.002834	.....	.....	
18,400	92,000	.024333	.003166	.....	.....	
19,200	96,000	.028000	.003667	.....	.....	
20,000	100,000	.031667	.003667	.....	.....	
20,800	104,000	.036333	.004666	.....	.....	
21,600	108,000	.042000	.005667	.....	.....	
22,400	112,000	.050000	.008000	.....	.....	
23,200	116,000	.061667	.011667	.....	.....	
23,940	119,700	.1000	.038333	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	119,700
Elastic limit per square inch of original section	do...	59,000
Elongation per inch after rupture	inch..	.1333
Elongation per inch under strain at elastic limit	do...	.002000
Reduction in diameter at point of rupture	do...	.065
Reduction in area after rupture, per cent of original section		23.9
Position of rupture		″.80 from neck
Character of broken surface		granular, radiating from a dull spot near the circumference
Elongation of inch sections		″.08, ″.12, ″.20*

No. 5699.

Marks, C 3.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000300	.000200	.....	.....	
4,000	20,000	.000633	.000333	.....	.....	
6,000	30,000	.001000	.000367	.....	.....	
8,000	40,000	.001333	.000333	.....	.....	
10,000	50,000	.001700	.000367	0.	.....	
11,000	55,000	.001867	.000167	.....	.....	
12,000	60,000	.002033	.000166	.....	.....	
12,200	61,000	.002067	.000034	.....	.....	
12,400	62,000	.002133	.000066	.....	.....	
12,600	63,000	.002167	.000034	.....	.....	Elastic limit.
12,800	64,000	.002300	.000133	.....	.....	
13,000	65,000	.002400	.000100	.....	.....	
						Load fell.
12,200	61,000	.003367	.000967	.....	.....	
12,400	62,000	.003733	.000366	.....	.....	
12,600	63,000	.004333	.000600	.....	.....	
12,800	64,000	.007167	.002834	.....	.....	
13,000	65,000	.009000	.001833	.....	.....	
13,200	66,000	.009600	.000600	.....	.....	
13,400	67,000	.010000	.000400	.....	.....	
13,600	68,000	.010500	.000500	.....	.....	
14,000	70,000	.012333	.001833	.....	.....	
14,400	72,000	.014000	.001667	.....	.....	
15,200	76,000	.017167	.003167	.....	.....	
16,000	80,000	.020333	.003166	.....	.....	
16,800	84,000	.024000	.003667	.....	.....	
17,600	88,000	.028000	.004000	.....	.....	
18,400	92,000	.033667	.005667	.....	.....	
19,200	96,000	.039667	.006000	.....	.....	
20,000	100,000	.046667	.007000	.....	.....	
20,800	104,000	.056667	.010000	.....	.....	
21,600	108,000	.071667	.005000	.....	.....	
22,140	110,700	.1200	.048333	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	110,700
Elastic limit per square inch of original section	do...	63,000
Elongation per inch after rupture	inch..	.1767
Elongation per inch under strain at elastic limit	do...	.002167
Reduction in diameter at point of rupture	do...	.085
Reduction in area after rupture, per cent of original section		30.7
Position of rupture		at middle of stem
Character of broken surface		silky, interspersed with fine granulation
Elongation of inch sections		".13, ".27*, ".13

No. 5706.

Marks, C 4.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000300	.000200	.....	.....	
4,000	20,000	.000633	.000333	.....	.....	
6,000	30,000	.000967	.000334	.....	.....	
8,000	40,000	.001333	.000366	.....	.....	
10,000	50,000	.001667	.000334	0.	.....	
12,000	60,000	.002033	.000366	.....	.....	
13,000	65,000	.002267	.000234	.000033	.000033	
14,000	70,000	.002433	.000166	.000033	0.	
16,000	80,000	.002867	.000434	.000067	.000034	
16,200	81,000	.002967	.000100	.....	.....	
16,400	82,000	.003000	.000033	.....	.....	
16,600	83,000	.003033	.000033	.....	.....	
16,800	84,000	.003033	0.	.....	.....	
17,000	85,000	.003100	.000067	.....	.....	
17,200	86,000	.003233	.000133	.....	.....	
17,400	87,000	.003300	.000067	.....	.....	
17,600	88,000	.003333	.000033	.....	.....	Elastic limit. Not well defined.
17,800	89,000	.003433	.000100	.....	.....	
18,000	90,000	.003633	.000200	.000433	.000366	
18,200	91,000	.003867	.000234	.....	.....	
18,400	92,000	.004033	.000166	.....	.....	
18,600	93,000	.004633	.000600	.....	.....	
18,800	94,000	.005167	.000534	.....	.....	
19,200	96,000	.008767	.003600	.....	.....	
19,600	98,000	.016000	.007233	.....	.....	
20,000	100,000	.021667	.005667	.....	.....	
20,800	104,000	.033333	.011666	.....	.....	
21,600	108,000	.050000	.016667	.....	.....	
22,340	111,700	.094667	.044667	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	111,700
Elastic limit per square inch of original section, not well defined	do...	88,000
Elongation per inch after rupture	inch..	.1767
Elongation per inch under strain at elastic limit	do...	003333
Reduction in diameter at point of rupture	do...	.185
Reduction in area after rupture, per cent of original section		59.8
Position of rupture		1″.1 from neck
Character of broken surface		fine silky, serrated edges
Elongation of inch sections		″.08, ″.17, ″.28*

8-INCH DISAPPEARING GUN CARRIAGES.

CAST-IRON SPECIMENS.

SPECIMENS WITH 2-INCH STEMS.

No. of test.	Mark on specimen.	Diameter.	Sectional area.	Tensile strength.		Appearance of fracture.
				Total.	Per square inch.	
		Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	
5410	P B R_1	1.129	1.00	24,200	24,200	Fine granular, spongy spot at circumference.
5411	do	1.129	1.00	27,800	27,800	Granular.
5412	P B R_2	1.129	1.00	28,100	28,100	Fine granular.
5413	do	1.129	1.00	25,250	25,250	Fine granular, light gray.
5416	P B R_4 T_3	1.129	1.00	30,780	30,780	Fine granular, gray.
5417	P B R_4 T_1	1.129	1.00	26,700	26,700	Fine granular, spongy spot at circumference.
5418	P B R_4 T_5	1.129	1.00	26,350	26,350	Fine granular, gray.
5419	P B R C_2	1.129	1.00	28,518	28,518	Do.

GROOVED SPECIMENS.

5414	B B R_1	1.129	1.00	24,700	24,700	Fine granular, gray.
5415	P B R_2	1.129	1.00	27,950	27,950	Fine granular, light gray.
5457	P T C_{19} 1 T_2	1.129	1.00	33,990	33,990	Fine granular, gray.

BASE RING.

No. 5593.

Marks, P. B. RE_1.
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 10″.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	
2,000	2,000	.00006	.00006	.....	.....	Initial load.
3,000	3,000	.00014	.00008	.....	.....	
4,000	4,000	.00021	.00007	.....	.....	
5,000	5,000	.00027	.00006	.....	.....	
6,000	6,000	.00034	.00007	.....	.....	
7,000	7,000	.00042	.00008	.....	.....	
8,000	8,000	.00049	.00007	.....	.....	
9,000	9,000	.00059	.00010	.....	.....	
10,000	10,000	.00067	.00008	.....	.....	
11,000	11,000	.00078	.00011	.....	.....	
12,000	12,000	.00089	.00011	.....	.....	
13,000	13,000	.00102	.00013	.....	.....	
14,000	14,000	.00117	.00015	.....	.....	
15,000	15,000	.00135	.00018	.....	.....	
16,000	16,000	.00153	.00018	.....	.....	
17,000	17,000	.00177	.00024	.....	.....	
18,000	18,000	.00205	.00028	.....	.....	
19,000	19,000	.00237	.00032	.....	.....	
20,000	20,000	.00272	.00035	.00117	.00117	
21,000	21,000	.00345	.00073	.....	.....	
22,000	22,000	.00398	.00053	.....	.....	
23,000	23,000	.00470	.00072	.....	.....	
24,000	24,000	.00545	.00075	.....	.....	
25,000	25,000	.00660	.00115	.00433	.00316	
26,990	26,990	.....	.....	.....	.....	Tensile strength.

Fractured ″.6 from neck. Appearance, fine granular, gray.

BASE RING.

No. 5594.

Marks, P B R E 2.
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 10″.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00012	.00006	.....	.....	
4,000	4,000	.00020	.00008	.....	.....	
5,000	5,000	.00026	.00006	.....	.....	
6,000	6,000	.00033	.00007	.....	.....	
7,000	7,000	.00039	.00006	.....	.....	
8,000	8,000	.00047	.00008	.....	.....	
9,000	9,000	.00054	.00007	.....	.....	
10,000	10,000	.00062	.00008	.00005	.00005	
11,000	11,000	.00071	.00009	.....	.....	
12,000	12,000	.00079	.00008	.....	.....	
13,000	13,000	.00088	.00009	.....	.....	
14,000	14,000	.00099	.00011	.....	.....	
15,000	15,000	.00109	.00010	.00014	.00009	
16,000	16,000	.00120	.00011	.....	.....	
17,000	17,000	.00131	.00011	.....	.....	
18,000	18,000	.00146	.00015	.....	.....	
19,000	19,000	.00159	.00013	.....	.....	
20,000	20,000	.00176	.00017	.00036	.00022	
21,000	21,000	.00194	.00018	.....	.....	
22,000	22,000	.00217	.00023	.....	.....	
23,000	23,000	.00231	.00014	.....	.....	
24,000	24,000	.00268	.00037	.....	.....	
25,000	25,000	.00300	.00032	.00106	.00070	
28,610	28,610	.....	.....	.....	.....	Tensile strength.

Fractured at the neck. Appearance, fine granular, gray.

BASE RING.

No. 5595.

Marks, P B R 4 E.
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 10″.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00011	.00005	.....	.....	
4,000	4,000	.00017	.00006	.....	.....	
5,000	5,000	.00023	.00006	.....	.....	
6,000	6,000	.00030	.00007	.....	.....	
7,000	7,000	.00037	.00007	.....	.....	
8,000	8,000	.00043	.00006	.....	.....	
9,000	9,000	.00049	.00006	.....	.....	
10,000	10,000	.00057	.00008	.00004	.00004	
11,000	11,000	.00064	.00007	.....	.....	
12,000	12,000	.00072	.00008	.....	.....	
13,000	13,000	.00081	.00009	.....	.....	
14,000	14,000	.00090	.00009	.....	.....	
15,000	15,000	.00099	.00009	.00015	.00011	
16,000	16,000	.00111	.00012	.....	.....	
17,000	17,000	.00123	.00012	.....	.....	
18,000	18,000	.00134	.00011	.....	.....	
19,000	19,000	.00150	.00016	.....	.....	
20,000	20,000	.00167	.00017	.00045	.00030	
21,000	21,000	.00188	.00021	.....	.....	
22,000	22,000	.00211	.00023	.....	.....	
23,000	23,000	.00234	.00023	.....	.....	
24,000	24,000	.00268	.00034	.....	.....	
25,000	25,000	.00305	.00037	.00140	.00095	
31,640	31,640	.....	.....	.....	.....	Tensile strength.

Fractured at the neck. Appearance, fine granular, light gray.

BASE RING.

No. 5596.

Marks, P B R 5 E.
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 10″.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00005	.00005	.....	.....	
3,000	3,000	.00009	.00004	.....	.....	
4,000	4,000	.00015	.00006	.....	.....	
5,000	5,000	.00020	.00005	.....	.....	
6,000	6,000	.00025	.00005	.....	.....	
7,000	7,000	.00032	.00007	.....	.....	
8,000	8,000	.00038	.00006	.....	.....	
9,000	9,000	.00045	.00007	.....	.....	
10,000	10,000	.00052	.00007	—.00001	—.00001	
11,000	11,000	.00059	.00007	.....	.....	
12,000	12,000	.00068	.00009	.....	.....	
13,000	13,000	.00078	.00010	.....	.....	
14,000	14,000	.00088	.00010	.....	.....	
15,000	15,000	.00099	.00011	.00010	.00011	
16,000	16,000	.00113	.00014	.....	.....	
17,000	17,000	.00126	.00013	.....	.....	
18,000	18,000	.00139	.00013	.....	.....	
19,000	19,000	.00159	.00020	.....	.....	
20,000	20,000	.00180	.00021	.00054	.00044	
21,000	21,000	.00220	.00040	.....	.....	
22,000	22,000	.00246	.00026	.....	.....	
23,000	23,000	.00272	.00026	.....	.....	
24,000	24,000	.00326	.00054	.....	.....	
25,000	25,000	.00399	.00073	.00202	.00148	
						Micrometer reset at zero.
1,000	1,000	.....	.....	.....	.....	
5,000	5,000	.00021	.00021	.....	.....	
10,000	10,000	.00055	.00034	.....	.....	
15,000	15,000	.00091	.00036	.....	.....	
20,000	20,000	.00132	.00041	.....	.....	
25,000	25,000	.00182	.00050	.....	.....	
1,000	1,000	.....	.....	.00006	.00006	
29,990	29,990	.....	.....	.....	.....	Tensile strength.

Fractured 0″.6 from neck. Appearance, fine granular, light gray.

BASE RING.

No. 5597.

Marks, P B R 6 E.
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 10″.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00010	.00006	.....	.....	
4,000	4,000	.00016	.00006	.....	.....	
5,000	5,000	.00022	.00006	.....	.....	
6,000	6,000	.00028	.00006	.....	.....	
7,000	7,000	.00033	.00005	.....	.....	
8,000	8,000	.00040	.00007	.....	.....	
9,000	9,000	.00047	.00007	.....	.....	
10,000	10,000	.00054	.00007	.00001	.00001	
11,000	11,000	.00061	.00007	.....	.....	
12,000	12,000	.00069	.00008	.....	.....	
13,000	13,000	.00077	.00008	.....	.....	
14,000	14,000	.00087	.00010	.....	.....	
15,000	15,000	.00096	.00009	.00009	.00008	
16,000	16,000	.00106	.00010	.....	.....	
17,000	17,000	.00117	.00011	.....	.....	
18,000	18,000	.00129	.00012	.....	.....	
19,000	19,000	.00142	.00013	.....	.....	
20,000	20,000	.00157	.00015	.00032	.00023	
21,000	21,000	.00172	.00015	.....	.....	
22,000	22,000	.00194	.00022	.....	.....	
23,000	23,000	.00216	.00022	.....	.....	
24,000	24,000	.00239	.00023	.....	.....	
25,000	25,000	.00272	.00033	.00108	.00071	
32,150	32,150	.....	.....	.....	.....	Tensile strength.

Fractured 1″ from neck. Appearance, fine granular, light gray.

BASE RING.

No. 5609.

Marks, P B R 7 E.
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 10″.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00005	.00005	.....	.....	
3,000	3,000	.00010	.00005	.....	.....	
4,000	4,000	.00016	.00006	.....	.....	
5,000	5,000	.00023	.00007	.....	.....	
6,000	6,000	.00030	.00007	.....	.....	
7,000	7,000	.00037	.00007	.....	.....	
8,000	8,000	.00045	.00008	.....	.....	
9,000	9,000	.00051	.00006	.....	.....	
10,000	10,000	.00060	.00009	.00002	.00002	
11,000	11,000	.00067	.00007	.....	.....	
12,000	12,000	.00077	.00010	.....	.....	
13,000	13,000	.00087	.00010	.....	.....	
14,000	14,000	.00098	.00011	.....	.....	
15,000	15,000	.00110	.00012	.00016	.00014	
16,000	16,000	.00124	.00014	.....	.....	
17,000	17,000	.00138	.00014	.....	.....	
18,000	18,000	.00156	.00018	.....	.....	
19,000	19,000	.00181	.00025	.....	.....	
20,000	20,000	.00205	.00024	.00067	.00051	
21,000	21,000	.00236	.00031	.....	.....	
22,000	22,000	.00276	.00040	.....	.....	
23,000	23,000	.00331	.00055	.....	.....	
24,000	24,000	.00376	.00045	.....	.....	
25,000	25,000	.00461	.00085	.00278	.00211	
28,630	28,630	.....	.....	.....	.....	Tensile strength.

Fractured 2″.60 from neck. Appearance, granular, light gray.

BASE RING.

No. 5610.

Marks, P B R 8 E.
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 10″.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00007	.00007	.....	.....	
3,000	3,000	.00014	.00007	.....	.....	
4,000	4,000	.00020	.00006	.....	.....	
5,000	5,000	.00027	.00007	.....	.....	
6,000	6,000	.00033	.00006	.....	.....	
7,000	7,000	.00040	.00007	.....	.....	
8,000	8,000	.00047	.00007	.....	.....	
9,000	9,000	.00054	.00007	.....	.....	
10,000	10,000	.00061	.00007	.00004	.00004	
11,000	11,000	.00069	.00008	.....	.....	
12,000	12,000	.00077	.00008	.....	.....	
13,000	13,000	.00086	.00009	.....	.....	
14,000	14,000	.00095	.00009	.....	.....	
15,000	15,000	.00106	.00011	.00014	.00010	
16,000	16,000	.00118	.00012	.....	.....	
17,000	17,000	.00130	.00012	.....	.....	
18,000	18,000	.00143	.00013	.....	.....	
19,000	19,000	.00159	.00016	.....	.....	
20,000	20,000	.00178	.00019	.00044	.00030	
21,000	21,000	.00197	.00019	.....	.....	
22,000	22,000	.00219	.00022	.....	.....	
23,000	23,000	.00244	.00025	.....	.....	
24,000	24,000	.00284	.00040	.....	.....	
25,000	25,000	.00330	.00046	.00149	.00105	
28,540	28,540	.....	.....	.....	.....	Tensile strength.

Fractured 2″.25 from neck. Appearance, granular, light gray.

BASE RING.

No. 5618.

Marks, B R 9 E.
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 10″.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00005	.00005	.....	.....	
3,000	3,000	.00012	.00007	.....	.....	
4,000	4,000	.00019	.00007	.....	.....	
5,000	5,000	.00025	.00006	.....	.....	
6,000	6,000	.00031	.00006	.....	.....	
7,000	7,000	.00039	.00008	.....	.....	
8,000	8,000	.00046	.00007	.....	.....	
9,000	9,000	.00053	.00007	.....	.....	
10,000	10,000	.00060	.00007	.00003	.00003	
11,000	11,000	.00068	.00008	.....	.....	
12,000	12,000	.00078	.00010	.....	.....	
13,000	13,000	.00088	.00010	.....	.....	
14,000	14,000	.00099	.00011	.....	.....	
15,000	15,000	.00110	.00011	.00016	.00013	
16,000	16,000	.00125	.00015	.....	.....	
17,000	17,000	.00138	.00013	.....	.....	
18,000	18,000	.00155	.00017	.....	.....	
19,000	19,000	.00175	.00020	.....	.....	
20,000	20,000	.00198	.00023	.00059	.00043	
21,000	21,000	.00225	.00027	.....	.....	
22,000	22,000	.00250	.00025	.....	.....	
23,000	23,000	.00283	.00033	.....	.....	
24,000	24,000	.00333	.00050	.....	.....	
25,000	25,000	.00387	.00054	.00197	.00138	
25,020	25,020	.....	.....	.....	.....	Tensile strength.

Fractured 1″.3 from neck. Appearance, fine granular, dark gray. Small spongy spot at the circumference.

BASE RING.

No. 5619.

Marks, B R 10 E.
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 10″.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00007	.00007			
3,000	3,000	.00015	.00008			
4,000	4,000	.00021	.00006			
5,000	5,000	.00028	.00007			
6,000	6,000	.00035	.00007			
7,000	7,000	.00042	.00007			
8,000	8,000	.00050	.00008			
9,000	9,000	.00058	.00008			
10,000	10,000	.00069	.00011	.00007	.00007	
11,000	11,000	.00078	.00009			
12,000	12,000	.00089	.00011			
13,000	13,000	.00100	.00011			
14,000	14,000	.00115	.00015			
15,000	15,000	.00131	.00016	.00029	.00022	
16,000	16,000	.00149	.00018			
17,000	17,000	.00170	.00021			
18,000	18,000	.00198	.00028			
19,000	19,000	.00227	.00029			
20,000	20,000	.00271	.00044	.00121	.00092	
21,000	21,000	.00319	.00048			
22,000	22,000	.00374	.00055			
23,000	23,000	.00489	.00115	.00303	.00182	
25,220	25,220					Tensile strength.

Fractured 1″.2 from neck. Appearance, fine granular, dark gray.

BASE RING.

No. 5620.

Marks, M B R 13.
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 10″.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00012	.00006	.....	.....	
4,000	4,000	.00018	.00006	.....	.....	
5,000	5,000	.00024	.00006	.....	.....	
6,000	6,000	.00031	.00007	.....	.....	
7,000	7,000	.00039	.00008	.....	.....	
8,000	8,000	.00048	.00009	.....	.....	
9,000	9,000	.00056	.00008	.....	.....	
10,000	10,000	.00066	.00010	.00005	.00005	
11,000	11,000	.00074	.00008	.....	.....	
12,000	12,000	.00086	.00012	.....	.....	
13,000	13,000	.00098	.00012	.....	.....	
14,000	14,000	.00112	.00014	.....	.....	
15,000	15,000	.00128	.00016	.00026	.00021	
16,000	16,000	.00145	.00017	.....	.....	
17,000	17,000	.00167	.00022	.....	.....	
18,000	18,000	.00190	.00023	.....	.....	
19,000	19,000	.00220	.00030	.....	.....	
20,000	20,000	.00257	.00037	.00105	.00079	
21,000	21,000	.00304	.00047	.....	.....	
22,000	22,000	.00343	.00039	.....	.....	
23,000	23,000	.00405	.00062	.....	.....	
24,000	24,000	.00485	.00080	.....	.....	
25,000	25,000	.00602	.00117	.00386	.00281	
25,520	25,520	.....	.....	.....	.....	Tensile strength.

Fractured at the neck. Appearance, granular.

BASE RING.

No. 5624.

Marks, $\frac{M\ B\ R\ 16}{E}$
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 10″.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00010	.00006	.....	.....	
4,000	4,000	.00015	.00005	.....	.....	
5,000	5,000	.00021	.00006	.....	.....	
6,000	6,000	.00024	.00003	.....	.....	
7,000	7,000	.00028	.00004	.....	.....	
8,000	8,000	.00033	.00005	.....	.....	
9,000	9,000	.00039	.00006	.....	.....	
10,000	10,000	.00046	.00007	.00002	.00002	
11,000	11,000	.00054	.00008	.....	.....	
12,000	12,000	.00064	.00010	.....	.....	
13,000	13,000	.00078	.00014	.....	.....	
14,000	14,000	.00092	.00014	.....	.....	
15,000	15,000	.00107	.00015	.00017	.00015	
16,000	16,000	.00123	.00016	.....	.....	
17,000	17,000	.00141	.00018	.....	.....	
18,000	18,000	.00165	.00024	.....	.....	
19,000	19,000	.00193	.00028	.....	.....	
20,000	20,000	.00228	.00035	.00093	.00076	
21,000	21,000	.00280	.00052	.....	.....	
22,000	22,000	.00342	.00062	.....	.....	
23,000	23,000	.00405	.00063	.....	.....	
24,000	24,000	.00500	.00095	.....	.....	
25,000	25,000	.00660	.00160	.00473	.00380	
25,980	25,980	.....	.....	.....	.....	Tensile strength.

Fractured ″.5 from neck. Appearance, fine granular, gray.

BASE RING.

No. 5625.

Marks, $\frac{M\ B\ R\ 18}{E}$
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 10″.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00012	.00006	.....	.....	
4,000	4,000	.00019	.00007	.....	.....	
5,000	5,000	.00025	.00006	.....	.....	
6,000	6,000	.00032	.00007	.....	.....	
7,000	7,000	.00040	.00008	.....	.....	
8,000	8,000	.00049	.00009	.....	.....	
9,000	9,000	.00055	.00006	.....	.....	
10,000	10,000	.00064	.00009	.00006	.00006	
11,000	11,000	.00072	.00008	.....	.....	
12,000	12,000	.00082	.00010	.....	.....	
13,000	13,000	.00091	.00009	.....	.....	
14,000	14,000	.00104	.00013	.....	.....	
15,000	15,000	.00116	.00012	.00018	.00012	
16,000	16,000	.00128	.00012	.....	.....	
17,000	17,000	.00143	.00015	.....	.....	
18,000	18,000	.00160	.00017	.....	.....	
19,000	19,000	.00179	.00019	.....	.....	
20,000	20,000	.00200	.00021	.00057	.00039	
21,000	21,000	.00225	.00025	.....	.....	
22,000	22,000	.00255	.00030	.....	.....	
23,000	23,000	.00295	.00040	.....	.....	
24,000	24,000	.00340	.00045	.....	.....	
25,000	25,000	.00385	.00045	.00188	.00131	
29,100	29,100	.....	.....	.....	.....	Tensile strength.

Fractured 1″.1 from neck. Appearance, fine granular, dark gray.

BASE RING.

No. 5638.

Marks, $\frac{M\ B\ R\ 21}{E}$
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 10″.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00005	.00005	.....	.....	
3,000	3,000	.00013	.00008	.....	.....	
4,000	4,000	.00019	.00006	.....	.....	
5,000	5,000	.00024	.00005	.....	.....	
6,000	6,000	.00031	.00007	.....	.....	
7,000	7,000	.00038	.00007	.....	.....	
8,000	8,000	.00045	.00007	.....	.....	
9,000	9,000	.00053	.00008	.....	.....	
10,000	10,000	.00059	.00006	.00005	.00005	
11,000	11,000	.00067	.00008	.....	.....	
12,000	12,000	.00076	.00009	.....	.....	
13,000	13,000	.00084	.00008	.....	.....	
14,000	14,000	.00094	.00010	.....	.....	
15,000	15,000	.00104	.00010	.00014	.00009	
16,000	16,000	.00114	.00010	.....	.....	
17,000	17,000	.00127	.00013	.....	.....	
18,000	18,000	.00140	.00013	.....	.....	
19,000	19,000	.00155	.00015	.....	.....	
20,000	20,000	.00172	.00017	.00043	.00029	
21,000	21,000	.00192	.00020	.....	.....	
22,000	22,000	.00211	.00019	.....	.....	
23,000	23,000	.00238	.00027	.....	.....	
24,000	24,000	.00264	.00026	.....	.....	
25,000	25,000	.00305	.00041	.00127	.00084	
25,610	25,610	.....	.....	.....	.....	

Fractured at the neck. Appearance, fine granular, gray. An elliptical-shaped spot, $\frac{1}{2}$″ by $\frac{1}{4}$″, presenting a bright, lustrous surface, was in the fractured surface near the circumference of the bar.

BASE RING.

No. 5640.

Marks, M B R 23.
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 10″.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00005	.00005			
3,000	3,000	.00011	.00006			
4,000	4,000	.00019	.00008			
5,000	5,000	.00025	.00006			
6,000	6,000	.00032	.00007			
7,000	7,000	.00039	.00007			
8,000	8,000	.00046	.00007			
9,000	9,000	.00053	.00007			
10,000	10,000	.00061	.00008	.00004	.00004	
11,000	11,000	.00070	.00009			
12,000	12,000	.00080	.00010			
13,000	13,000	.00090	.00010			
14,000	14,000	.00101	.00011			
15,000	15,000	.00112	.00011	.00016	.00012	
16,000	16,000	.00123	.00011			
17,000	17,000	.00137	.00014			
18,000	18,000	.00155	.00018			
19,000	19,000	.00173	.00018			
20,000	20,000	.00194	.00021	.00055	.00039	
21,000	21,000	.00217	.00023			
22,000	22,000	.00244	.00027			
23,000	23,000	.00275	.00031			
24,000	24,000	.00320	.00045			
24,020	24,020					Tensile strength.

Fractured 1″ from neck. Appearance, medium fine granular, gray. Small smooth lustrous spot at circumference of bar.

BASE RING.

No. 5670.

Marks, $\frac{M\ B\ R\ 25}{E}$
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 10″.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00005	.00005			
3,000	3,000	.00009	.00004			
4,000	4,000	.00015	.00006			
5,000	5,000	.00021	.00006			
6,000	6,000	.00027	.00006			
7,000	7,000	.00031	.00004			
8,000	8,000	.00039	.00008			
9,000	9,000	.00044	.00005			
10,000	10,000	.00051	.00007	.00001	.00001	
11,000	11,000	.00057	.00006			
12,000	12,000	.00064	.00007			
13,000	13,000	.00070	.00006			
14,000	14,000	.00078	.00008			
15,000	15,000	.00086	.00008	.00005	.00004	
16,000	16,000	.00094	.00008			
17,000	17,000	.00102	.00008			
18,000	18,000	.00111	.00009			
19,000	19,000	.00121	.00010			
20,000	20,000	.00131	.00010	.00018	.00013	
21,000	21,000	.00146	.00015			
22,000	22,000	.00158	.00012			
23,000	23,000	.00174	.00016			
24,000	24,000	.00190	.00016			
25,000	25,000	.00211	.00021	.00056	.00038	
33,980	33,980					Tensile strength.

Fractured 1″.5 from neck. Appearance, fine granular, light gray.

TOP CARRIAGE.

No. 5636.

Marks, $\frac{\text{M T C. 20}}{\text{E}}$
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 10″.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation. per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00005	.00005	.....	.....	
3,000	3,000	.00012	.00007	.....	.....	
4,000	4,000	.00018	.00006	.....	.....	
5,000	5,000	.00027	.00009	.....	.....	
6,000	6,000	.00034	.00007	.....	.....	
7,000	7,000	.00041	.00007	.....	.....	
8,000	8,000	.00050	.00009	.....	.....	
9,000	9,000	.00057	.00007	.....	.....	
10,000	10,000	.00066	.00009	.00005	.00005	
11,000	11,000	.00074	.00008	.....	.....	
12,000	12,000	.00085	.00011	.....	.....	
13,000	13,000	.00094	.00009	.....	.....	
14,000	14,000	.00107	.00013	.....	.....	
15,000	15,000	.00123	.00016	.00022	.00017	
16,000	16,000	.00140	.00017	.....	.....	
17,000	17,000	.00155	.00015	.....	.....	
18,000	18,000	.00175	.00020	.....	.....	
19,000	19,000	.00198	.00023	.....	.....	
20,000	20,000	.00230	.00032	.00082	.00060	
21,000	21,000	.00265	.00035	.....	.....	
22,000	22,000	.00305	.00040	.....	.....	
23,000	23,000	.00360	.00055	.....	.....	
24,000	24,000	.00425	.00065	.....	.....	
25,000	25,000	.00503	.00078	.00296	.00214	
28,180	28,180	.....	.....	.....	.....	Tensile strength.

Fractured 3″.25 from the neck. Appearance, fine granular, gray.

TOP CARRIAGE.

No. 5639.

Marks, $\frac{M\ T\ C.\ 22}{E}$
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 10″.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00007	.00007	.....	.....	
3,000	3,000	.00015	.00008	.....	.....	
4,000	4,000	.00022	.00007	.....	.....	
5,000	5,000	.00030	.00008	.....	.....	
6,000	6,000	.00039	.00009	.....	.....	
7,000	7,000	.00048	.00009	.....	.....	
8,000	8,000	.00056	.00008	.....	.....	
9,000	9,000	.00066	.00010	.....	.....	
10,000	10,000	.00077	.00011	.00012	.00012	
11,000	11,000	.00089	.00012	.....	.....	
12,000	12,000	.00099	.00010	.....	.....	
13,000	13,000	.00117	.00018	.....	.....	
14,000	14,000	.00134	.00017	.....	.....	
15,000	15,000	.00154	.00020	.00045	.00033	
16,000	16,000	.00179	.00025	.....	.....	
17,000	17,000	.00209	.00030	.....	.....	
18,000	18,000	.00248	.00039	.....	.....	
19,000	19,000	.00290	.00042	.....	.....	
20,000	20,000	.00359	.00069	.00195	.00150	
21,000	21,000	.00435	.00076	.....	.....	
22,000	22,000	.00555	.00120	.00365	.00170	
24,810	24,810	.....	.....	.....	.....	Tensile strength.

Fractured 3″.4 from neck. Appearance, medium fine granular, gray.

TOP CARRIAGE.

No. 5650.

Marks, $\frac{M\ T\ C.\ 24}{E}$
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00005	.00005			
3,000	3,000	.00012	.00007			
4,000	4,000	.00018	.00006			
5,000	5,000	.00024	.00006			
6,000	6,000	.00032	.00008			
7,000	7,000	.00039	.00007			
8,000	8,000	.00047	.00008			
9,000	9,000	.00055	.00008			
10,000	10,000	.00061	.00006	.00004	.00004	
11,000	11,000.	.00069	.00008			
12.000	12,000	.00078	.00009			
13,000	13,000	.00089	.00011			
14,000	14,000	.00100	.00011			
15,000	15,000	.00113	.00013	.00016	.00012	
16.000	16,000	.00127	.00014			
17,000	17,000	.00140	.00013			
18,000	18,000	.00158	.00018			
19,000	19,000	.00183	.00025			
20,000	20,000	.00210	.00027	.00070	.00054	
21,000	21,000	.00240	.00030			
22,000	22,000	.00275	.00035			
23,000	23,000	.00325	.00050			
24,000	24,000	.00384	.00059			
25,000	25,000	.00460	.00076	.00269	.00199	
28,510	28,510					Tensile strength.

Fractured at the neck. Appearance, fine granular, gray.

TOP CARRIAGE.

No. 5671.

Marks, $\frac{M\ T\ Ca\ 26}{E}$
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 10″.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00005	.00005	.....	.....	
3,000	3,000	.00014	.00009	.....	.....	
4,000	4,000	.00021	.00007	.....	.....	
5,000	5,000	.00027	.00006	.....	.....	
6,000	6,000	.00033	.00006	.....	.....	
7,000	7,000	.00040	.00007	.....	.....	
8,000	8,000	.00047	.00007	.....	.....	
9,000	9,000	.00055	.00008	.....	.....	
10,000	10,000	.00061	.00006	.00004	.00004	
11,000	11,000	.00070	.00009	.....	.....	
12,000	12,000	.00079	.00009	.....	.....	
13,000	13,000	.00089	.00010	.....	.....	
14,000	14,000	.00099	.00010	.....	.....	
15,000	15,000	.00110	.00011	.00015	.00011	
16,000	16,000	.00122	.00012	.....	.....	
17,000	17,000	.00135	.00013	.....	.....	
18,000	18,000	.00155	.00020	.....	.....	
19,000	19,000	.00169	.00014	.....	.....	
20,000	20,000	.00192	.00023	.00055	.00040	
21,000	21,000	.00214	.00022	.....	.....	
22,000	22,000	.00243	.00029	.....	.....	
23,000	23,000	.00272	.00029	.....	.....	
24,000	24,000	.00325	.00053	.....	.....	
25,000	25,000	.00373	.00048	.00183	.00128	
29,930	29,930	.....	.....	.....	.....	Tensile strength.

Fractured 2″.35 from neck. Appearance, fine granular, dark gray.

Top Carriage.

No. 5685.

Marks, $\frac{M\ T\ Ca\ 27}{E}$
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 10″.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00013	.00007	.....	.....	
4,000	4,000	.00019	.00006	.....	.....	
5,000	5,000	.00024	.00005	.....	.....	
6,000	6,000	.00030	.00006	.....	.....	
7,000	7,000	.00037	.00007	.....	.....	
8,000	8,000	.00042	.00005	.....	.....	
9,000	9,000	.00050	.00008	.....	.....	
10,000	10,000	.00055	.00005	0.	.....	
11,000	11,000	.00062	.00007	.....	.....	
12,000	12,000	.00070	.00008	.....	.....	
13,000	13,000	.00079	.00009	.....	.....	
14,000	14,000	.00087	.00008	.....	.....	
15,000	15,000	.00094	.00007	.00009	.00009	
16,000	16,000	.00105	.00011	.....	.....	
17,000	17,000	.00115	.00010	.....	.....	
18,000	18,000	.00124	.00009	.....	.....	
19,000	19,000	.00138	.00014	.....	.....	
20,000	20,000	.00152	.00014	.00027	.00018	
21,000	21,000	.00167	.00015	.....	.....	
22,000	22,000	.00182	.00015	.....	.....	
23,000	23,000	.00201	.00019	.....	.....	
24,000	24,000	.00223	.00022	.....	.....	
25,000	25,000	.00249	.00026	.00062	.00055	
30,150	30,150	.....	.....	.....	.....	Tensile strength.

Fractured 3″.75 from neck. Appearance, granular, light gray.

Top Carriage.

No. 5686.

Marks, $\frac{M\ T\ Ca\ 28}{E}$
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 10″.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00011	.00005	.....	.....	
4,000	4,000	.00016	.00005	.....	.....	
5,000	5,000	.00024	.00008	.....	.....	
6,000	6,000	.00030	.00006	.....	.....	
7,000	7,000	.00035	.00005	.....	.....	
8,000	8,000	.00046	.00011	.....	.....	
9,000	9,000	.00050	.00004	.....	.....	
10,000	10,000	.00056	.00006	.00003	.00003	
11,000	11,000	.00064	.00008	.....	.....	
12,000	12,000	.00072	.00008	.....	.....	
13,000	13,000	.00079	.00007	.....	.....	
14,000	14,000	.00088	.00009	.....	.....	
15,000	15,000	.00096	.00008	.00010	.00007	
16,000	16,000	.00106	.00010	.....	.....	
17,000	17,000	.00116	.00010	.....	.....	
18,000	18,000	.00126	.00010	.....	.....	
19,000	19,000	.00140	.00014	.....	.....	
20,000	20,000	.00154	.00014	.00027	.00017	
21,000	21,000	.00168	.00014	.....	.....	
22,000	22,000	.00183	.00015	.....	.....	
23,000	23,000	.00200	.00017	.....	.....	
24,000	24,000	.00221	.00021	.....	.....	
25,000	25,000	.00248	.00027	.00081	.00054	
32,610	32,610	.....	.....	.....	.....	Tensile strength.

Fractured 2″.9 from neck. Appearance, fine granular, light gray.

TOP CARRIAGE.

No. 5690.

Marks, $\frac{M\ T\ Ca\ 29}{E}$
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 10″.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006			
3,000	3,000	.00011	.00005			
4,000	4,000	.00016	.00005			
5,000	5,000	.00023	.00007			
6,000	6,000	.00028	.00005			
7,000	7,000	.00035	.00007			
8,000	8,000	.00041	.00006			
9,000	9,000	.00049	.00008			
10,000	10,000	.00055	.00006	.00002	.00002	
11,000	11,000	.00061	.00006			
12,000	12,000	.00070	.00009			
13,000	13,000	.00078	.00008			
14,000	14,000	.00086	.00008			
15,000	15,000	.00094	.00008	.00008	.00006	
16,000	16,000	.00103	.00009			
17,000	17,000	.00114	.00011			
18,000	18,000	.00123	.00009			
19,000	19,000	.00134	.00011			
20,000	20,000	.00147	.00013	.00022	.00014	
21,000	21,000	.00158	.00011			
22,000	22,000	.00174	.00016			
23,000	23,000	.00190	.00016			
24,000	24,000	.00207	.00017			
24,200	24,200					Tensile strength.

Fractured 3″ from the neck. Appearance, fine granular, mottled. Fracture contained a spot of smooth, lustrous metal, triangular shaped, ″.25 by ″.50.

TOP CARRIAGE.

No. 5691.

Marks, $\frac{M\ T\ Ca\ 30}{E}$
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 10″.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00011	.00005	.....	.....	
4,000	4,000	.00017	.00006	.....	.....	
5,000	5,000	.00024	.00007	.....	.....	
6,000	6,000	.00031	.00007	.....	.....	
7,000	7,000	.00037	.00006	.....	.....	
8,000	8,000	.00046	.00009	.....	.....	
9,000	9,000	.00052	.00006	.....	.....	
10,000	10,000	.00060	.00008	.00004	.00004	
11,000	11,000	.00067	.00007	.....	.....	
12,000	12,000	.00076	.00009	.....	.....	
13,000	13,000	.00085	.00009	.....	.....	
14,000	14,000	.00096	.00011	.....	.....	
15,000	15,000	.00104	.00008	.00015	.00011	
16,000	16,000	.00118	.00014	.....	.....	
17,000	17,000	.00131	.00013	.....	.....	
18,000	18,000	.00146	.00015	.....	.....	
19,000	19,000	.00162	.00016	.....	.....	
20,000	20,000	.00181	.00019	.00050	.00035	
21,000	21,000	.00203	.00022	.....	.....	
22,000	22,000	.00226	.00023	.....	.....	
23,000	23,000	.00257	.00031	.....	.....	
24,000	24,000	.00298	.00041	.....	.....	
25,000	25,000	.00345	.00047	.00166	.00116	
28,780	28,780	.....	.....	.....	.....	Tensile strength.

Fractured 4″.5 from neck. Appearance, fine granular, light gray, mottled.

TOP CARRIAGE.

No. 5700.

Marks, $\frac{M\ T\ Ca\ 31}{E}$
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 10″.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00005	.00005	.....	.....	
3,000	3,000	.00011	.00006	.....	.....	
4,000	4,000	.00018	.00007	.....	.....	
5,000	5,000	.00023	.00005	.....	.....	
6,000	6,000	.00030	.00007	.....	.....	
7,000	7,000	.00037	.00007	.....	.....	
8,000	8,000	.00042	.00005	.....	.....	
9,000	9,000	.00050	.00008	.....	.....	
10,000	10,000	.00057	.00007	.00001	.00001	
11,000	11,000	.00064	.00007	.....	.....	
12,000	12,000	.00071	.00007	.....	.....	
13,000	13,000	.00080	.00009	.....	.....	
14,000	14,000	.00090	.00010	.....	.....	
15,000	15,000	.00101	.00011	.00011	.00010	
16,000	16,000	.00110	.00009	.....	.....	
17,000	17,000	.00120	.00010	.....	.....	
18,000	18,000	.00131	.00011	.....	.....	
19,000	19,000	.00141	.00010	.....	.....	
20,000	20,000	.00158	.00017	.00030	.00019	
21,000	21,000	.00171	.00013	.....	.....	
22,000	22,000	.00189	.00018	.....	.....	
23,000	23,000	.00210	.00021	.....	.....	
24,000	24,000	.00230	.00020	.....	.....	
25,000	25,000	.00259	.00029	.00083	.00053	
31,410	31,410	.....	.....	.....	.....	Tensile strength.

Fractured ″.9 from neck. Appearance, fine granular, gray.

Top Carriage, Prolongation.

No. 5710.

Marks, M T C$_s$. 31.
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 6″.
Gauged length, 5″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00010	.00006	.....	.....	
4,000	4,000	.00016	.00006	.....	.....	
5,000	5,000	.00020	.00004	.....	.....	
6,000	6,000	.00026	.00006	.....	.....	
7,000	7,000	.00034	.00008	.....	.....	
8,000	8,000	.00040	.00006	.....	.....	
9,000	9,000	.00046	.00006	.....	.....	
10,000	10,000	.00054	.00003	.00002	.00002	
11,000	11,000	.00060	.00006	.....	.....	
12,000	12,000	.00068	.00008	.....	.....	
13,000	13,000	.00076	.00008	.....	.....	
14,000	14,000	.00084	.00008	.....	.....	
15,000	15,000	.00094	.00010	.00006	.00004	
16,000	16,000	.00104	.00010	.....	.....	
17,000	17,000	.00114	.00010	.....	.....	
18,000	18,000	.00124	.00010	.....	.....	
19,000	19,000	.00138	.00014	.....	.....	
20,000	20,000	.00152	.00014	.00026	.00020	
21,000	21,000	.00166	.00014	.....	.....	
22,000	22,000	.00180	.00014	.....	.....	
23,000	23,000	.00202	.00022	.....	.....	
24,000	24,000	.00226	.00024	.....	.....	
25,000	25,000	.00250	.00024	.00082	.00056	
26,000	26,000	.00280	.00030	.....	.....	
27,000	27,000	.00322	.00042	.....	.....	
28,000	28,000	.00366	.00044	.00162	.00080	
29,000	29,000	.00426	.00060	.....	.....	
29,980	29,980	.....	.....	.....	.....	Tensile strength.

Fractured ″.3 from the neck. Appearance, granular, dark gray.

TOP CARRIAGE, PROLONGATION.

No. 5711.

Marks, M T C_a 31.
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 5″.
Gauged length, 5″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00004	.00004			
3,000	3,000	.00010	.00006			
4,000	4,000	.00016	.00006			
5,000	5,000	.00022	.00006			
6,000	6,000	.00028	.00006			
7,000	7,000	.00032	.00004			
8,000	8,000	.00040	.00008			
9,000	9,000	.00046	.00006			
10,000	10,000	.00052	.00006	.00002	.00002	
11,000	11,000	.00060	.00008			
12,000	12,000	.00068	.00008			
13,000	13,000	.00076	.00008			
14,000	14,000	.00086	.00010			
15,000	15,000	.00096	.00010	.00008	.00006	
16,000	16,000	.00104	.00008			
17,000	17,000	.00116	.00012			
18,000	18,000	.00124	.00008			
19,000	19,000	.00140	.00016			
20,000	20,000	.00154	.00014	.00028	.00020	
21,000	21,000	.00170	.00016			
22,000	22,000	.00188	.00018			
23,000	23,000	.00204	.00016			
24,000	24,000	.00226	.00022			
25,000	25,000	.00254	.00028	.00082	.00054	
26,000	26,000	.00292	.00038			
26,200	26,200					Tensile strength.

Fractured ″.50 from neck. Appearance, granular, gray.

TOP CARRIAGE.

No. 5701.

Marks, $\frac{M\ T\ C.\ 32}{E}$
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 10″.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00011	.00007	.....	.....	
4,000	4,000	.00018	.00007	.....	.....	
5,000	5,000	.00022	.00004	.....	.....	
6,000	6,000	.00030	.00008	.....	.....	
7,000	7,000	.00035	.00005	.....	.....	
8,000	8,000	.00041	.00006	.....	.....	
9,000	9,000	.00049	.00008	.....	.....	
10,000	10,000	.00054	.00005	.00003	.00003	
11,000	11,000	.00062	.00008	.....	.....	
12,000	12,000	.00071	.00009	.....	.....	
13,000	13,000	.00080	.00009	.....	.....	
14,000	14,000	.00088	.00008	.....	.....	
15,000	15,000	.00097	.00009	.00010	.00007	
16,000	16,000	.00108	.00011	.....	.....	
17,000	17,000	.00117	.00009	.....	.....	
18,000	18,000	.00128	.00011	.....	.....	
19,000	19,000	.00140	.00012	.....	.....	
20,000	20,000	.00152	.00012	.00028	.00018	
21,000	21,000	.00170	.00018	.....	.....	
22,000	22,000	.00188	.00018	.....	.....	
23,000	23,000	.00203	.00015	.....	.....	
24,000	24,000	.00224	.00021	.....	.....	
25,000	25,000	.00251	.00027	.00075	.00047	
25,780	25,780	.....	.....	.....	.....	Tensile strength.

Fractured 2″.1 from neck. Appearance, fine granular, light gray. Surface contains a smooth lustrous spot $\frac{1}{8}$″ by $\frac{3}{8}$″.

TOP CARRIAGE.

No. 5709.

Marks, $\frac{M\ T\ Ca\ 33}{E}$
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 10″.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00007	.00007	.....	.....	
3,000	3,000	.00011	.00004	.....	.....	
4,000	4,000	.00019	.00008	.....	.....	
5,000	5,000	.00025	.00006	.....	.....	
6,000	6,000	.00030	.00005	.....	.....	
7,000	7,000	.00038	.00008	.....	.....	
8,000	8,000	.00044	.00006	.....	.....	
9,000	9,000	.00050	.00006	.....	.....	
10,000	10,000	.00057	.00007	.00004	.00004	
11,000	11,000	.00065	.00008	.....	.....	
12,000	12,000	.00071	.00006	.....	.....	
13,000	13,000	.00080	.00009	.....	.....	
14,000	14,000	.00089	.00009	.....	.....	
15,000	15,000	.00099	.00010	.00010	.00006	
16,000	16,000	.00107	.00008	.....	.....	
17,000	17,000	.00117	.00010	.....	.....	
18,000	18,000	.00128	.00011	.....	.....	
19,000	19,000	.00139	.00011	.....	.....	
20,000	20,000	.00150	.00011	.00026	.00016	
21,000	21,000	.00164	.00014	.....	.....	
22,000	22,000	.00178	.00014	.....	.....	
23,000	23,000	.00194	.00016	.....	.....	
24,000	24,000	.00209	.00015	.....	.....	
25,000	25,000	.00231	.00022	.00061	.00035	
30,310	30,310	.....	.....	.....	.....	Tensile strength.

Fractured at the neck. Appearance, fine granular, light gray, mottled.

TOP CARRIAGE.

No. 5714.

Marks, $\frac{P\ T\ Ca\ 84}{E}$
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 10″.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00010	.00004	.....	.....	
4,000	4,000	.00016	.00006	.....	.....	
5,000	5,000	.00020	.00004	.....	.....	
6,000	6,000	.00027	.00007	.....	.....	
7,000	7,000	.00031	.00004	.....	.....	
8,000	8,000	.00038	.00007	.....	.....	
9,000	9,000	.00044	.00006	.....	.....	
10,000	10,000	.00050	.00006	0.	.....	
11,000	11,000	.00057	.00007	.....	.....	
12,000	12,000	.00062	.00005	.....	.....	
13,000	13,000	.00070	.00008	.....	.....	
14,000	14,000	.00078	.00008	.....	.....	
15,000	15,000	.00084	.00006	.00005	.00005	
16,000	16,000	.00092	.00008	.....	.....	
17,000	17,000	.00100	.00008	.....	.....	
18,000	18,000	.00108	.00008	.....	.....	
19,000	19,000	.00118	.00010	.....	.....	
20,000	20,000	.00127	.00009	.00010	.00005	
21,000	21,000	.00135	.00008	.....	.....	
22,000	22,000	.00144	.00009	.....	.....	
23,000	23,000	.00154	.00010	.....	.....	
24,000	24,000	.00164	.00010	.....	.....	
25,000	25,000	.00178	.00014	.00024	.00014	
26,000	26,000	.00191	.00013	.....	.....	
27,000	27,000	.00203	.00012	.....	.....	Tensile strength.

Fractured 4″ from neck. Appearance, granular, light gray, mottled. Fractured surface contains a spot of smooth, lustrous metal ″.45 by ″.10.

RACK GUIDE.

No. 5626.

Marks, P R G 17.
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 10″.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00005	.00005			
3,000	3,000	.00011	.00006			
4,000	4,000	.00017	.00006			
5,000	5,000	.00024	.00007			
6,000	6,000	.00029	.00005			
7,000	7,000	.00036	.00007			
8,000	8,000	.00044	.00008			
9,000	9,000	.00051	.00007			
10,000	10,000	.00058	.00007	.00003	.00003	
11,000	11,000	.00065	.00007			
12,000	12,000	.00074	.00009			
13,000	13,000	.00083	.00009			
14,000	14,000	.00093	.00010			
15,000	15,000	.00104	.00011	.00012	.00009	
16,000	16,000	.00114	.00010			
17,000	17,000	.00128	.00014			
18,000	18,000	.00140	.00012			
19,000	19,000	.00157	.00017			
20,000	20,000	.00176	.00019	.00041	.00029	
21,000	21,000	.00196	.00020			
22,000	22,000	.00218	.00022			
23,000	23,000	.00245	.00027			
24,000	24,000	.00281	.00036			
25,000	25,000	.00321	.00040	.00130	.00089	
32,820	32,820					Tensile strength.

Fractured 2″ from neck. Appearance, fine granular, light gray.

RACK GUIDE.

No. 5637.

Marks, $\frac{P\ R\ G\ 19}{E}$
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 10″.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.0 006	.....	.....	
3,000	3,000	.00013	.00007	.....	.....	
4,000	4,000	.00020	.00007	.....	.....	
5,000	5,000	.00026	.00006	.....	.....	
6,000	6,000	.00033	.00007	.....	.....	
7,000	7,000	.00040	.00007	.....	.....	
8,000	8,000	.00048	.00008	.....	.....	
9,000	9,000	.00056	.00008	.....	.....	
10,000	10,000	.00064	.00008	.00005	.00005	
11,000	11,000	.00072	.00008	.....	.....	
12,000	12,000	.00083	.00011	.....	.....	
13,000	13,000	.00090	.00007	.....	.....	
14,000	14,000	.00102	.00012	.....	.....	
15,000	15,000	.00115	.00013	.00019	.00014	
16,000	16,000	.00130	.00015	.....	.....	
17,000	17,000	.00142	.00012	.....	.....	
18,000	18,000	.00160	.00018	.....	.....	
19,000	19,000	.00179	.00019	.....	.....	
20,000	20,000	.00203	.00024	.00060	.00041	
21,000	21,000	.00225	.00022	.....	.....	
22,000	22,000	.00255	.00030	.....	.....	
23,000	23,000	.00296	.00041	.....	.....	
24,000	24,000	.00340	.00044	.....	.....	
25,000	25,000	.00393	.00053	.00194	.00134	
31,020	31,020	.....	.....	.....	.....	Tensile strength.

Fractured at the neck. Appearance, fine granular, dark gray.

No. 5621.

Marks, 1.
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 9″.
Gauged length, 9″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000067	.000067	.....	.....	
3,000	3,000	.000100	.000033	.....	.....	
4,000	4,000	.000167	.000067	.....	.....	
5,000	5,000	.000256	.000089	.....	.....	
6,000	6,000	.000334	.000078	.....	.....	
7,000	7,000	.000423	.000089	.....	.....	
8,000	8,000	.000523	.000100	.....	.....	
9,000	9,000	.000623	.000100	.....	.....	
10,000	10,000	.000734	.000111	.000056	.000056	
11,000	11,000	.000844	.000110	.....	.....	
12,000	12,000	.000967	.000123	.....	.....	
13,000	13,000	.001111	.000144	.....	.....	
14,000	14,000	.001267	.000156	.....	.....	
15,000	15,000	.001456	.000189	.000311	.000255	
16,000	16,000	.001667	.000211	.....	.....	
17,000	17,000	.001934	.000267	.....	.....	
18,000	18,000	.002244	.000310	.....	.....	
19,000	19,000	.002656	.000412	.....	.....	
20,000	20,000	.003056	.000400	.001344	.001033	
21,000	21,000	.003778	.000722	.....	.....	
22,000	22,000	.004500	.000722	.....	.....	
23,000	23,000	.005889	.001389	.....	.....	
23,810	23,810	.....	.....	.....	.....	Tensile strength.

Fractured 1″.7 from neck. Appearance, fine granular, gray.

No. 5622.

Marks, 2.
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 9″.
Gauged length, 9″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000044	.000044	.....	.....	
3,000	3,000	.000133	.000089	.....	.....	
4,000	4,000	.000167	.000034	.....	.....	
5,000	5,000	.000278	.000111	.....	.....	
6,000	6,000	.000344	.000066	.....	.....	
7,000	7,000	.000444	.000100	.....	.....	
8,000	8,000	.000522	.000078	.....	.....	
9,000	9,000	.000611	.000089	.....	.....	
10,000	10,000	.000700	.000089	.000044	.000044	
11,000	11,000	.000811	.000111	.....	.....	
12,000	12,000	.000922	.000111	.....	.....	
13,000	13,000	.001089	.000167	.....	.....	
14,000	14,000	.001222	.000133	.....	.....	
15,000	15,000	.001344	.000122	.000300	.000256	
16,000	16,000	.001633	.000289	.....	.....	
17,000	17,000	.001900	.000267	.....	.....	
18,000	18,000	.002178	.000278	.....	.....	
19,000	19,000	.002556	.000378	.....	.....	
20,000	20,000	.003122	.000566	.001489	.001189	
21,000	21,000	.003878	.000756	.....	.....	
22,000	22,000	.004722	.000844	.....	.....	
23,000	23,000	.005889	.001167	.....	.....	
24,000	24,000	.008056	.002167	.....	.....	Tensile strength.

Fractured at the neck. Appearance, fine granular, gray.

No. 5623.

Marks, 3.
Diameter, 1″.129.
Sectional area, 1.00 square inch.
Length of stem, 9″.
Gauged length, 9″.

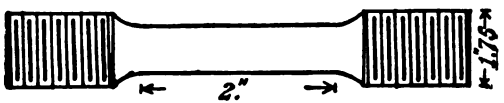
Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000044	.000044	.....	.....	
3,000	3,000	.000100	.000056	.....	.....	
4,000	4,000	.000156	.000056	.....	.....	
5,000	5,000	.000222	.000066	.....	.....	
6,000	6,000	.000289	.000067	.....	.....	
7,000	7,000	.000378	.000089	.....	.....	
8,000	8,000	.000500	.000122	.....	.....	
9,000	9,000	.000622	.000122	.....	.....	
10,000	10,000	.000767	.000145	.000100	.000100	
11,000	11,000	.000978	.000211	.....	.....	
12,000	12,000	.001167	.000189	.....	.....	
13,000	13,000	.001389	.000222	.....	.....	
14,000	14,000	.001656	.000267	.....	.....	
15,000	15,000	.002000	.000344	.....	.....	
16,000	16,000	.002433	.000433	.....	.....	
17,000	17,000	.003056	.000623	.....	.....	
18,000	18,000	.003833	.000777	.....	.....	
18,710	18,710	.....	.....	.....	.....	Tensile strength.

Fractured at the neck. Appearance, granular, dark gray. Contains coarse spangles.

CHEMICAL ANALYSES OF CAST IRON FOR 8-INCH DISAPPEARING CARRIAGES.

No. of test.	Description.	Mark on specimen.	Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.
			Total.	Graphitic.	Combined.				
5620	Base ring	M B R 18	2.972	2.645	0.227	0.455	1.034	0.111	0.802
5626	Rack guide	P R G 17	3.125	2.527	.598	.500	1.240	.129	.348
5671	Top carriage	M T Ca 26 E	3.217	2.661	.556	.370	1.050	.143	.328
5686	.....do	M T Ca 28 E	3.067	2.219	.848	.382	1.231	.120	.396

8-INCH DISAPPEARING GUN CARRIAGE—STEEL AND WROUGHT IRON.



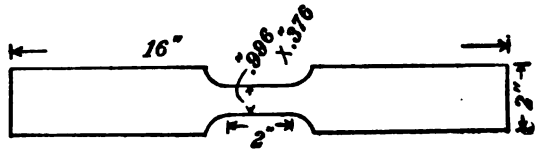
G S 9. Merchantable steel proposed for smaller parts.
B B 10. From stock of wrought iron proposed for use.

No. of test.	Mark on specimen.	Diameter.	Sectional area.	Elastic limit.		Ultimate strength.		Elongation in 2 inches.		Area at fracture	Contraction of area.	Appearance of fracture.
				Total.	Per square inch.	Total.	Per square inch.	Inch.	Per cent.			
		Inch.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*			*In. Sq. in.*	*Per cent.*	
8778	G S 9	.505	.20	10,210	51,050	14,980	74,900	60	30	Diam. .34 = .091	54.5	Fine silky, cup shaped.
8779	B B 10	.505	.20	6,920	34,600	10,410	52,050	.60	30	Diam. .35 = .096	52.0	Fibrous.

Steel Plate for Shot Trays of Ammunition Trucks.

8-inch disappearing carriages.

No. 9131.



Marks, $\frac{A\ M\ T\ R}{S\ T}$
Sectional area, ".996 by ".376 = .374 square inch.
Elastic limit, 14,400 pounds = 38,500 pounds per square inch.
Tensile strength, 23,650 pounds = 63,230 pounds per square inch.
Elongation in 2 inches, ".71 = 35.5 per cent.
Elongation of inch sections, ".39*, ".32*.
Area at fracture, ".72 by ".25 = .180 square inch.
Contraction of area, 51.8 per cent.
Appearance of fracture, silky.

10-INCH DISAPPEARING GUN CARRIAGE.

STEEL CASTINGS.

No. 5551.

Marks, 363 R R 3.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000150	.000150	0.	.....	
2,000	10,000	.000300	.000150	.....	.....	
4,000	20,000	.000750	.000450	.000050	.000050	
4,200	21,000	.000800	.000050	.....	.....	Elastic limit.
4,400	22,000	.001050	.000250	.....	.....	
4,600	23,000	.001250	.000200	.....	.....	
4,800	24,000	.001450	.000200	.....	.....	
5,000	25,000	.001700	.000250	.000850	.000800	
5,200	26,000	.002250	.000550	.....	.....	
5,400	27,000	.004000	.001750	.....	.....	
5,600	28,000	.005450	.001450	.....	.....	
5,800	29,000	.006700	.001250	.....	.....	
6,000	30,000	.007600	.000900	.006500	.005650	
6,400	32,000	.0100	.0024	.....	.....	
6,800	34,000	.0150	.0050	.....	.....	
7,200	36,000	.0150+	.0000+	.....	.....	
7,600	38,000	.0200	.0050	.....	.....	
8,000	40,000	.0250	.0050	.....	.....	
8,400	42,000	.0250+	.0000+	.....	.....	
8,800	44,000	.0300	.0050	.....	.....	
9,200	46,000	.0350	.0050	.....	.....	
9,600	48,000	.0400	.0050	.....	.....	
10,000	50,000	.0450	.0050	.....	.....	
10,400	52,000	.0500	.0050	.....	.....	
10,800	54,000	.0600	.0100	.....	.....	
11,200	56,000	.0700	.0100	.....	.....	
11,600	58,000	.0850	.0150	.....	.....	
12,000	60,000	.1050	.0200	.....	.....	
12,400	62,000	.1400	.0350	.....	.....	
12,690	63,450	.2650	.0650	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	63,450
Elastic limit per square inch of original section	do...	21,000
Elongation per inch after rupture	inch..	.2800
Elongation per inch under strain at elastic limit	do...	.000800
Reduction in diameter at point of rupture	do...	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		1".2 from neck
Character of broken surface		silky, with 10 per cent granular metal interspersed

No. 5552.

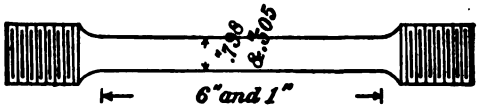
Marks, 365 R T_2.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000150	.000150	.....	.....	
2,000	10,000	.000300	.000150	.....	.....	
4,000	20,000	.000650	.000350	.....	.....	
4,200	21,000	.000700	.000050	.....	.....	
4,400	22,000	.000800	.000100	.....	.....	Elastic limit.
4,600	23,000	.001000	.000200	.....	.....	
4,800	24,000	.001300	.000300	.....	.....	
5,000	25,000	.002150	.000850	.001300	.001300	
5,200	26,000	.003200	.001050	.....	.....	
5,400	27,000	.004000	.000800	.....	.....	
5,600	28,000	.004750	.000750	.....	.....	
5,800	29,000	.006150	.001400	.....	.....	
6,000	30,000	.007500	.001350	.006450	.005150	
6,400	32,000	.0100	.0025	.....	.....	
6,800	34,000	.0150	.0050	.....	.....	
7,200	36,000	.0150+	.0000+	.....	.....	
7,600	38,000	.0200	.0050	.....	.....	
8,000	40,000	.0200+	.0000+	.....	.....	
8,400	42,000	.0250	.0050	.....	.....	
8,800	44,000	.0300	.0050	.....	.....	
9,200	46,000	.0250	.0050	.....	.....	
9,600	48,000	.0400	.0050	.....	.....	
10,000	50,000	.0450	.0050	.....	.....	
10,400	52,000	.0500	.0050	.....	.....	
10,800	54,000	.0550	.0050	.....	.....	
11,200	56,000	.0650	.0100	.....	.....	
11,600	58,000	.0800	.0150	.....	.....	
12,000	60,000	.0950	.0150	.....	.....	
12,400	62,000	.1200	.0250	.....	.....	
12,800	64,000	.1750	.0550	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pound..	64,000
Elastic limit per square inch of original section	do...	22,000
Elongation per inch after rupture	inch..	.1950
Elongation per inch under strain at elastic limit	do...	.000800
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		″.7 from neck.
Character of broken surface		coarse granular, flaky.

12-INCH DISAPPEARING CARRIAGE.



Specimens from crop ends of axle.

No. of test.	Diameter.	Sectional area.	Elastic limit.		Ultimate strength.		Elongation in 6 inches.		Area at fracture.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
			Total.	Per square inch.	Total.	Per square inch.	Inches.	Per cent.				
	Inch.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*			*Inches. Sq. in.*	*Per cent.*		
8757	.798	.50	25,200	50,400	38,100	76,200	.15	2.5	Diam., .79=.490	2	Granular	″.02, ″.03, ″.02, ″.04*, ″.02, ″.02.
8758	.798	.50	18,400	36,800	40,180	80,360	1.10	18.3	Diam., .68=.363	27.4	Granular with a dull, silky spot at the circumference. Opened cracks in surface of stem.	″.11, ″.13, ″.16, ″.24, ″.30*, ″.16.
							Elongation in 1-inch.					
8761	.505	.20	.....	.....	21,320	106,600	.24	24	Diam., .43=.145	27.5	Granular, dull leaden color near center.	
8762	.505	.20	6,400	32,000	17,630	88,150	.29	29	Diam., .39=.119	40.5	Silky, with trace of granulation.	

ANCHOR BOLTS

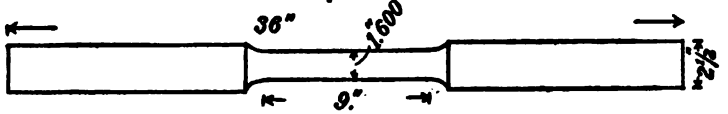
FOR

12-INCH EMPLACEMENTS AT GREAT GULL ISLAND, NEW YORK.

TENSION AND BENDING TESTS.

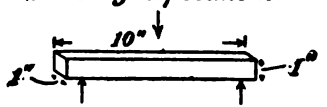
Bolts Forwarded by The Berlin Iron Bridge Company, East Berlin, Conn.

Tension Specimens.



No. of test.	Taken from.	Diameter.	Sectional area.	Elastic limit.		Ultimate strength.		Elongation in 8 inches.		Area at fracture.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
				Total.	Per square inch.	Total.	Per square inch.	Inches.	Per cent.				
		Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*			*Inches. Sq. in.*	*Per ct.*		" " " " " " " "
9298	Short bolt...	1.600	2.01	47,800	23,780	106,120	52,800	2.62	32.8	Diam. 1.15=1.04	48.2	Silky; cup-shaped.	.20, .24, .28, .32, .52*, .57*, .29, .20
9299	Long bolt...	1.600	2.01	49,200	24,480	103,700	51,590	2.74	34.3	Diam. 1.14=1.02	49.2	.....do.....	.20, .27, .29, .37, .74*, .39, .27, .21

Bending Specimens.



One sample from each bolt machined to 1″ by 1″ by 10″ long, bent cold 180°, and closed down upon itself without fracture on the outside of the bend. Shearing fractures were started on the inside of the bend in the sample from the short bolt, attributed to an indentation made by the corners of the plunger in starting the bend.

In the second sample the sharp corners of this indentation were smoothed off with a file. No shearing fractures were developed in the second sample.

CARRIAGE FOR 12-INCH B. L. RIFLED MORTAR.

SPECIMENS FROM A RUPTURED HYDRAULIC CYLINDER.

No. 5598.

Marks, 56 T 1.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000150	.000150	0.	.....	
2,000	10,000	.000300	.000150	.....	.....	
4,000	20,000	.000600	.000300	0.	.....	
5,000	25,000	.000850	.000250	.....	.....	
5,600	28,000	.000950	.000100	.....	.....	
5,800	29,000	.001000	.000050	.....	.....	Elastic limit.
6,000	30,000	.001550	.000550	.000550	.000550	
6,200	31,000	.002650	.001100	.....	.....	
6,400	32,000	.004000	.001350	.....	.....	
6,600	33,000	.004400	.000400	.....	.....	
6,800	34,000	.004950	.000550	.....	.....	
7,000	35,000	.006750	.001800	.005500	.004950	
8,000	40,000	.0100	.003250	.....	.....	
9,000	45,000	.0150	.0050	.....	.....	
10,000	50,000	.0200	.0050	.....	.....	
11,000	55,000	.0250	.0050	.....	.....	
12,000	60,000	.0350	.0100	.....	.....	
13,000	65,000	.0550	.0200	.....	.....	
14,000	70,000	.0750	.0200	.....	.....	
14,410	72,050	.1150	.0400	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	72,050
Elastic limit per square inch of original section	do...	29,000
Elongation per inch after rupture	inch..	.1750
Elongation per inch under strain at elastic limit	do...	.001000
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		".9 from neck
Character of broken surface		granular 80 per cent, dull silky 20 per cent
Elongation of inch sections		".19*, ".16

No. 5599.

Marks, 56 T 2.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000150	.000150	0.	.....	
2,000	10,000	.000400	.000250	.....	.....	
3,000	15,000	.000700	.000300	0.	.....	
4,000	20,000	.000950	.000250	.....	.....	
5,000	25,000	.001100	.000150	0.	.....	
5,200	26,000	.001150	.000050	.....	.....	
5,400	27,000	.001200	.000050	.....	.....	
5,600	28,000	.001300	.000100	.....	.....	Elastic limit.
5,800	29,000	.002000	.000700	.....	.....	
6,000	30,000	.002650	.000650	.001250	.001250	
6,200	31,000	.003250	.000600	.....	.....	
6,400	32,000	.004200	.000950	.....	.....	
6,600	33,000	.004900	.000700	.....	.....	
6,800	34,000	.006250	.001350	.....	.....	
7,000	35,000	.007300	.001050	.005650	.004400	
8,000	40,000	.0150	.0077	.....	.....	
9,000	45,000	.0200	.0050	.....	.....	
10,000	50,000	.0300	.0100	.....	.....	
11,000	55,000	.0450	.0150	.....	.....	
12,000	60,000	.0600	.0150	.....	.....	
13,000	65,000	.0850	.0250	.....	.....	
13,740	68,700	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	68,700
Elastic limit per square inch of original section	do...	28,000
Elongation per inch after rupture	inch..	.1350
Elongation per inch under strain at elastic limit	do...	.001300
Reduction in diameter at point of rupture	do...	.055
Reduction in area after rupture, per cent of original section		20.5
Position of rupture		1″ from neck
Character of broken surface		granular, 75 per cent; dull flaky, 25 per cent
Elongation of inch sections		″.15, ″.12

No. 5600.

Marks, 56 L 1.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000250	.000150	.....	.....	
3,000	15,000	.000450	.000200	.....	.....	
4,000	20,000	.000650	.000200	0.	.....	
4,600	23,000	.000850	.000200	.....	.....	
4,800	24,000	.000900	.000050	.....	.....	Elastic limit.
5,000	25,000	.001150	.000250	.000250	.000250	
5,200	26,000	.001400	.000250	.....	.....	
5,400	27,000	.001900	.000500	.....	.....	
5,600	28,000	.002450	.000550	.....	.....	
5,800	29,000	.002800	.000350	.....	.....	
6,000	30,000	.003150	.000350	.002200	.001950	
6,200	31,000	.003700	.000550	.....	.....	
6,400	32,000	.004600	.000900	.....	.....	
6,600	33,000	.006000	.001400	.....	.....	
6,800	34,000	.007000	.001000	.....	.....	
7,000	35,000	.008250	.001250	.007050	.004850	
8,000	40,000	.0150	.006750	.....	.....	
9,000	45,000	.0250	.0100	.....	.....	
10,000	50,000	.0350	.0100	.....	.....	
11,000	55,000	.0500	.0150	.....	.....	
12,000	60,000	.0700	.0200	.....	.....	
13,000	65,000	.1000	.0300	.....	.....	
13,690	68,450	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	68,450
Elastic limit per square inch of original section	do...	24,000
Elongation per inch after rupture	inch..	.1850
Elongation per inch under strain at elastic limit	do...	.000900
Reduction in diameter at point of rupture	do...	.065
Reduction in area after rupture, per cent of original section		23.9
Position of rupture		1" from neck
Character of broken surface		dull silky, oblique, contains small spots of granular metal
Elongation of inch sections		".19*, ".18

No. 5601.

Marks, 57 T 1.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000150	.000150	0.	.....	
2,000	10,000	.000350	.000200	.....	.....	
3,000	15,000	.000550	.000200	.....	.....	
4,000	20,000	.000700	.000150	0.	.....	
5,000	25,000	.000950	.000250	.000100	.000100	Elastic limit.
5,200	26,000	.001150	.000200	.....	.....	
5,400	27,000	.001350	.000200	.....	.....	
5,600	28,000	.001600	.000250	.....	.....	
5,800	29,000	.001900	.000300	.....	.....	
6,000	30,000	.002250	.000350	.001350	.001250	
6,200	31,000	.003050	.000800	.....	.....	
6,400	32,000	.004200	.001150	.....	.....	
6,600	33,000	.004850	.000650	.....	.....	
6,800	34,000	.005750	.000900	.....	.....	
7,000	35,000	.006750	.001000	.005600	.004250	
8,000	40,000	.0150	.008250	.....	.....	
9,000	45,000	.0200	.0050	.....	.....	
10,000	50,000	.0300	.0100	.....	.....	
11,000	55,000	.0400	.0100	.....	.....	
12,000	60,000	.0550	.0150	.....	.....	
13,000	65,000	.0750	.0200	.....	.....	
14,000	70,000	.1250	.0500	.....	.....	
14,160	70,800	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	70,800
Elastic limit per square inch of original section	do...	25,000
Elongation per inch after rupture	inch..	.1650
Elongation per inch under strain at elastic limit	do...	.000950
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		1″ from neck
Character of broken surface		granular, 85 per cent; dull, silky spot at circumference, 15 per cent
Elongation of inch sections		″.17*″.16

No. 5602.

Marks, 57 T 2.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000150	.000150	0.	.....	
2,000	10,000	.000300	.000150	.....	.....	
3,000	15,000	.000450	.000150	.....	.....	
4,000	20,000	.000700	.000250	0.	.....	
4,200	21,000	.000750	.000050	.....	.....	
4,400	22,000	.000800	.000050	.....	.....	
4,600	23,000	.000850	.000050	.....	.....	
4,800	24,000	.000850	0.	.....	.....	Elastic limit.
5,000	25,000	.001000	.000150	.000100	.000100	
5,200	26,000	.001150	.000150	.....	.....	
5,400	27,000	.001300	.000150	.....	.....	
5,600	28,000	.001500	.000200	.....	.....	
5,800	29,000	.001750	.000250	.....	.....	
6,000	30,000	.002100	.000350	.001150	.001050	
6,200	31,000	.002950	.000850	.....	.....	
6,400	32,000	.003750	.000800	.....	.....	
6,600	33,000	.004500	.000750	.....	.....	
6,800	34,000	.005500	.001000	.....	.....	
7,000	35,000	.006750	.001250	.....	.....	
8,000	40,000	.0150	.008250	.....	.....	
9,000	45,000	.0200	.0050	.....	.....	
10,000	50,000	.0300	.0100	.....	.....	
11,000	55,000	.0400	.0100	.....	.....	
12,000	60,000	.0550	.0150	.....	.....	
13,000	65,000	.0750	.0200	.....	.....	
14,000	70,000	.1200	.0450	.....	.....	
14,270	71,350	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	71,350
Elastic limit per square inch of original section	do...	24,000
Elongation per inch after rupture	inch..	.1500
Elongation per inch under strain at elastic limit	do...	.000850
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		″.9 from neck
Character of broken surface		granular; dull, silky spot at the circumference
Elongation of inch sections		″.13, ″.17*

No. 5603.

Marks, 57 L 1.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000300	.000200	.....	.....	
3,000	15,000	.000450	.000150	.....	.....	
4,000	20,000	.000600	.000150	0.	.....	
4,200	21,000	.000650	.000050	.....	.....	
4,400	22,000	.000700	.000050	.....	.....	
4,600	23,000	.000800	.000100	.....	.....	
4,800	24,000	.000850	.000050	.....	.....	Elastic limit.
5,000	25,000	.001050	.000200	.000200	.000200	
5,200	26,000	.001400	.000350	.....	.....	
5,400	27,000	.001850	.000450	.....	.....	
5,600	28,000	.002250	.000400	.....	.....	
5,800	29,000	.002700	.000450	.....	.....	
6,000	30,000	.003750	.001050	.002600	.002400	
6,200	31,000	.004400	.000650	.....	.....	
6,400	32,000	.005700	.001300	.....	.....	
6,600	33,000	.006750	.001050	.....	.....	
6,800	34,000	.008100	.001350	.....	.....	
7,000	35,000	.009150	.001050	.007850	.005250	
8,000	40,000	.0200	.010850	.....	.....	
9,000	45,000	.0250	.0050	.....	.....	
10,000	50,000	.0350	.0100	.....	.....	
11,000	55,000	.0500	.0150	.....	.....	
12,000	60,000	.0700	.0200	.....	.....	
13,000	65,000	.1100	.0400	.....	.....	
13,310	66,550	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	66,550
Elastic limit per square inch of original section	do...	24,000
Elongation per inch after rupture	inch..	.1550
Elongation per inch under strain at elastic limit	do...	.000850
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		".75 from neck
Character of broken surface		granular
Elongation of inch sections		".13, ".18*

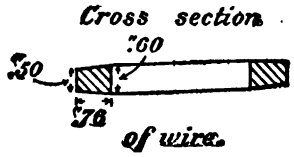
HELICAL SPRINGS

FOR

7-INCH MORTAR CARRIAGES, MODEL 1895.

COMPRESSION TESTS.

No. 8747.



No. of spring.	Weight.	Exterior diameter.	Diameter of wire.	Height unloaded.	Load when compressed to height of 6 inches.	Closed down.		Load when returned to height of 6 inches.
						Load.	Height.	
	Lbs. oz.	*Inches.*	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*	*Inches.*	*Pounds.*
1	8 14	4.46	.55×.75	7.04	1,195	3,400	4.18	1,154
2	8 15	4.50	.55×.76	7.00	1,205	3,300	4.18	1,007
3	9 $\frac{1}{8}$	4.54	.55×.77	7.02	1,285	3,700	4.17	1,100
4	9 $\frac{1}{8}$	4.50	.55×.76	7.06	1,288	3,700	4.16	1,052
5	8 15$\frac{1}{8}$	4.52	.55×.76	6.99	1,240	3,750	4.19	1,033
6	8 14$\frac{3}{8}$	4.50	.55×.76	7.03	1,265	3,500	4.18	1,052
7	8 15$\frac{1}{8}$	4.52	.55×.77	7.06	1,342	3,850	4.18	1,136
8	8 15	4.50	.55×.77	6.98	1,230	3,600	4.16	1,004
9	9 $\frac{1}{8}$	4.53	.55×.77	7.06	1,225	3,550	4.13	1,078
10	8 14$\frac{3}{8}$	4.50	.55×.75	7.02	1,268	3,720	4.11	1,230

The tenth spring closed down and thus remained 17 hours.

Load sustained when returned to height of 6 inches, 1,116 pounds.

Spring now loaded 100 times, closing to a height of 4$\frac{1}{4}$ inches, and releasing between each loading to a height of 6 inches.

Height, 6″; load sustained, 1,000 pounds.

Height, 4$\frac{1}{8}$″; load sustained, 3,680 pounds.

Height, 6″; load sustained, 973 pounds.

PISTON RODS, PROOF STRESS.

PROOF STRESS APPLIED TO PISTON RODS FOR GUN CARRIAGES.

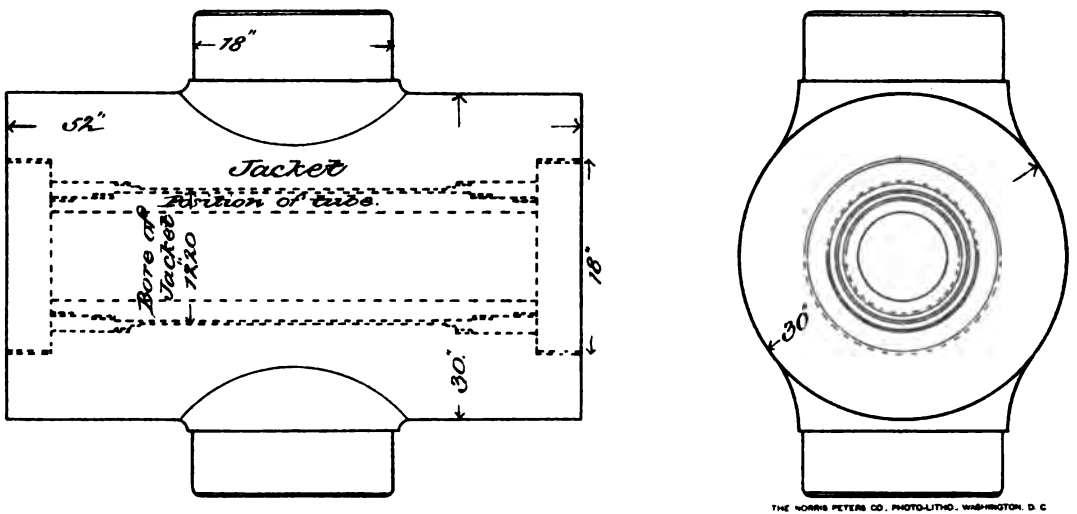
No. of test.	Description.	Total length.	Diameters.			Tensile stress applied.
			Maximum.	Minimum.	Root of thread.	
		Inches.	*Inches.*	*Inches.*	*Inches.*	*Pounds.*
8928	12″ barbette carriage	100.50	4.00	3.50	3.35	200,000
8929	12″ disappearing carriage	219.75	4.75	4.25	4.07	116,000
	10″ disappearing carriage	179.45	3.50	3.00	2.83	116,000

HYDROSTATIC TEST OF 8-INCH TUBE SECTION.

Plate 1.

Hydrostatic test, 8-inch tube section.

Steel jacket for retaining tube section while under tests with exterior pressures.

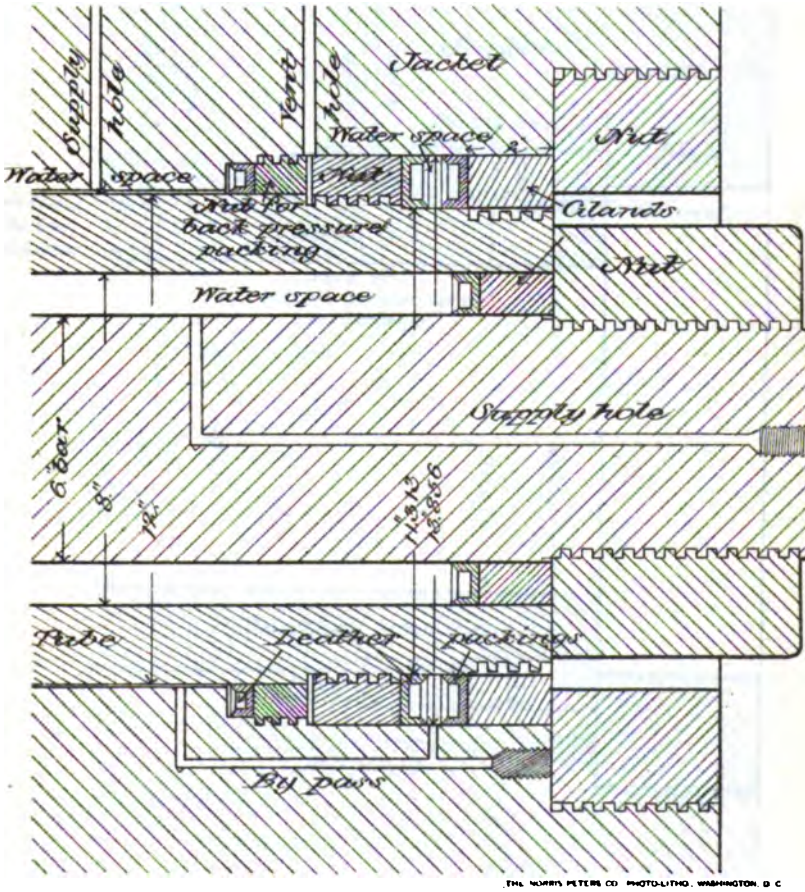


THE WORMS PETERS CO. PHOTO-LITHO. WASHINGTON. D. C.

Plate 10.

Hydrostatic test, 8" tube section.

Test with interior and exterior pressures and longitudinal compression combined.

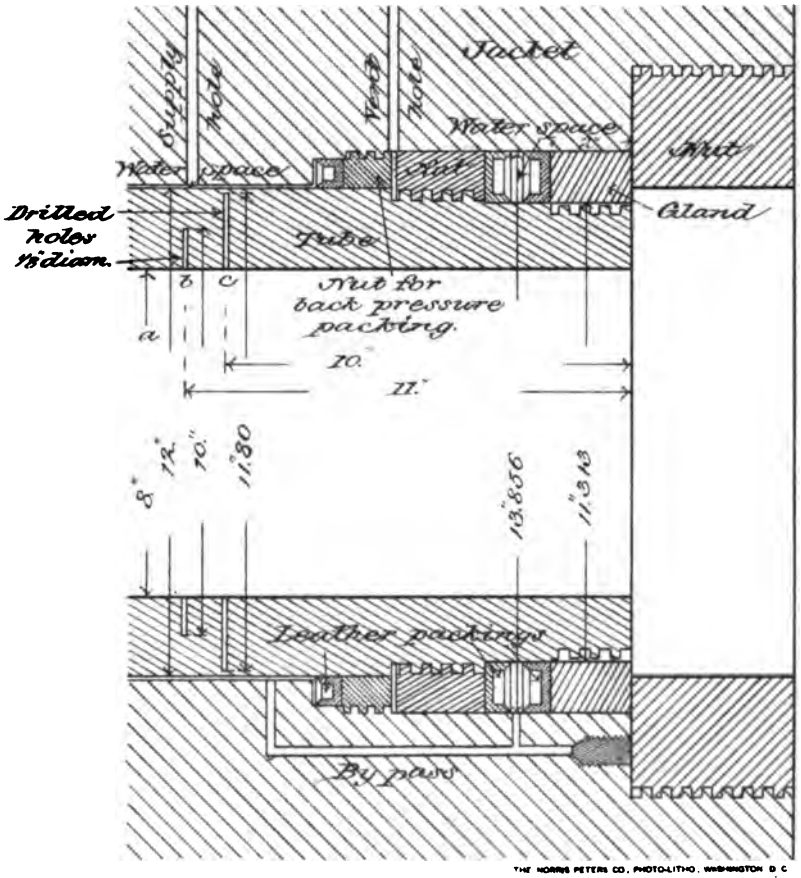


THE HENRY PETERS CO PHOTO-LITHO. WASHINGTON, D C

Plate 11.

Hydrostatic test, 8" tube section.

Test with exterior pressure and longitudinal compression combined.

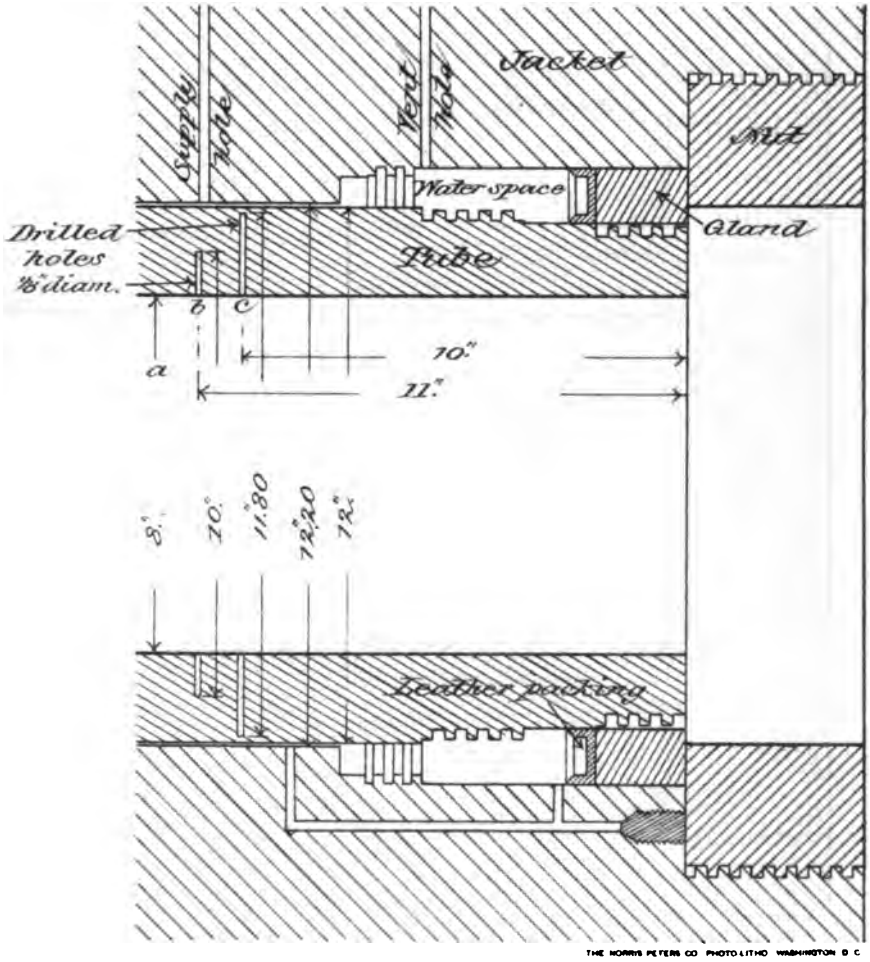


THE HORNS PETERS CO. PHOTO-LITHO. WASHINGTON D.C.

Plate 12.

Hydrostatic test, 8" tube section.

Test with exterior pressure.

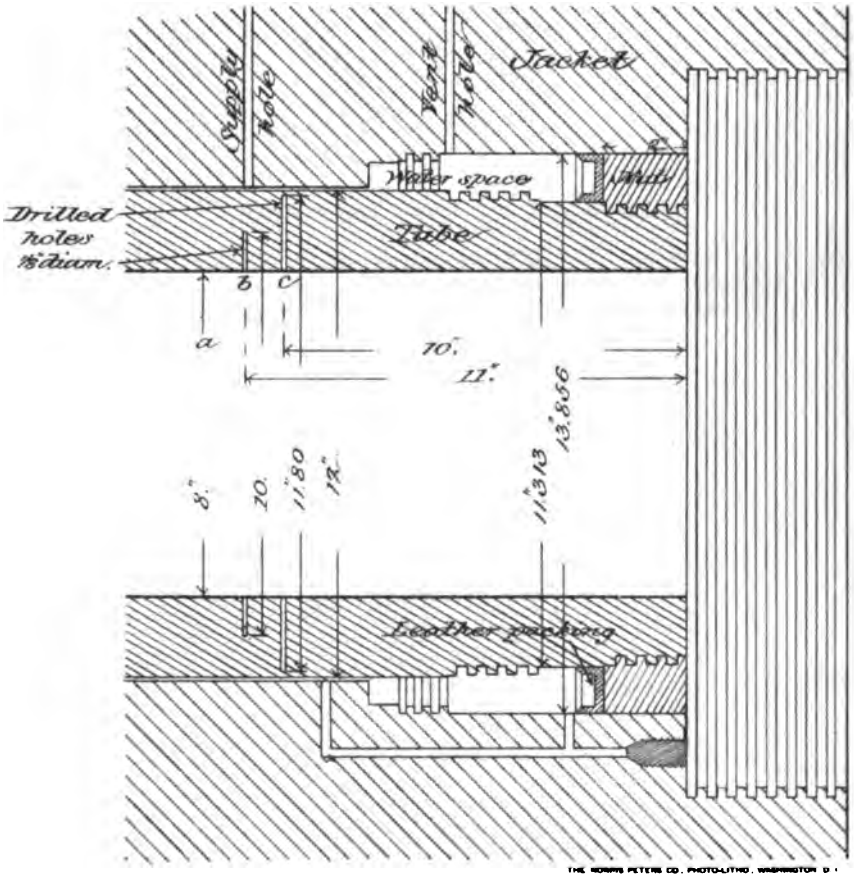


THE NORRIS PETERS CO PHOTO-LITHO WASHINGTON D C

Plate 13.

Hydrostatic test. 8" tube section.

Test with exterior pressure and longitudinal tension combined.



THE BYRON PETERS CO. PHOTO-LITHO. WASHINGTON D. C.

TEST WITH INTERIOR AND EXTERIOR PRESSURES AND LONGITUDINAL COMPRESSION COMBINED.

Observations repeated. For original measurements see Report 1894, page 306.

LONGITUDINAL CONTRACTION.

Pressure per square inch.	Measurements of 20-inch longitudinal.				Remarks.
	E.	Successive differences.	W.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
11,000	19.9989	.....	.....	.....	
1,000	20.0000	.0011	20.0000	.....	
11,000	19.9989	.0011	19.9994	.0006	
1,000	20.0002	.0013	20.0000	.0006	
11,000	19.9990	.0012	19.9995	.0005	
1,000	20.0002	.0012	20.0000	.0005	
11,000	19.9989	.0013	19.9995	.0005	
1,000	20.0001	.0012	20.0001	.0006	
11,000	19.9990	.0011	19.9995	.0006	
1,000	20.0000	.0010	20.0000	.0005	
11,000	19.9989	.0011	.....	.....	
1,000	20.0000	.0011	.....	.....	

TEST WITH INTERIOR PRESSURE.

The tube remained within the jacket with all the packings in place as in the preceding test. Hydrostatic pressure was admitted to the bore of the tube only. The exterior water spaces were vented.

LONGITUDINAL CONTRACTION.

Pressure per square inch.	Measurements of 20-inch longitudinal.				Remarks.
	W.	Successive differences.	E.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
11,000	19.9971	.....	.....	.....	
1,000	20.0000	.0029	20.0000	.....	
11,000	19.9970	.0030	19.9971	.0029	
1,000	20.0000	.0030	20.0001	.0030	
11,000	19.9971	.0029	19.9971	.0030	
1,000	20.0000	.0029	20.0001	.0030	
11,000	.....	.....	19.9971	.0030	
1,000	.....	.....	20.0001	.0030	

OBSERVATIONS ON THE CHANGE IN LENGTH OF THE TUBE WHEN STRAINED WITH (*a*) INTERIOR PRESSURE ALONE, AND WITH (*b*) INTERIOR AND EXTERIOR PRESSURES COMBINED WITH LONGITUDINAL COMPRESSION.

Measurements taken on east 20″ longitudinal.

Pressure per square inch.	Micrometer reading.	Manner of loading.	
Pounds.	*Inch.*		
1,000	.0218	*b*	
1,000	.0217+	*a*	
1,000	.0219	*b*	
1,000	.0218+	*a*	

Hence it appears that the tube is about ″.0001 longer in condition *b* over condition *a*.

TEST WITH EXTERIOR PRESSURE AND LONGITUDINAL COMPRESSION COMBINED.

The tube remained within the jacket with all the packings in place as arranged for a test with interior and exterior pressures, with longitudinal compression combined.

In the present instance connections with the piping for interior pressure were disconnected.

Observations repeated. For original measurements see report 1894, page 306.

LONGITUDINAL EXTENSION.

Pressure per square inch.	Measurements of 20-inch longitudinal.				Remarks.
	E.	Successive difference.	W.	Successive difference.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
1,000	20.0000	.....	.....	.....	
11,000	20.0016	.0016	20.0024	.....	
1,000	20.0000	.0016	20.0000	.0024	
11,000	20.0016	.0016	20.0023	.0023	
1,000	20.0001	.0015	20.0000	.0023	
11,000	20.0017	.0016	20.0024	.0024	
1,000	20.0001	.0016	20.0000	.0024	
11,000	20.0017	.0016	20.0024	.0024	
1,000	19.9999	.0018	20.0000	.0024	
11,000	20.0017	.0018	.....	.....	
1,000	20.0000	.0017	.....	.....	

TUBE ROTATED 180° AND TEST REPEATED WITH EXTERIOR PRESSURE AND LONGITUDINAL COMPRESSION COMBINED.

LONGITUDINAL EXTENSION.

Pressure per square inch.	Measurements of 20-inch longitudinal.				Remarks.
	E.	Successive differences.	W.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
11,000	20.0016	.....	.....	.....	
1,000	20.0000	.0016	20.0000	.....	
11,000	20.0016	.0016	20.0024	.0024	
1,000	20.0000	.0016	20.0001	.0023	
11,000	20.0016	.0016	20.0024	.0023	
1,000	20.0001	.0015	20.0001	.0023	
11,000	20.0016	.0015	20.0025	.0024	
1,000	20.0000	.0016	20.0004	.0021	
11,000	.....	.....	20.0024	.0020	
1,000	.....	.....	20.0002	.0022	
					Rested 40 minutes.
11,000	.....	.....	20.0021	.0019	
1,000	.....	.....	20.0000	.0021	
11,000	.....	.....	20.0024	.0024	
1,000	.....	.....	20.0000	.0024	
11,000	.....	.....	20.0024	.0024	
1,000	.....	.....	20.0001	.0023	
11,000	.....	.....	20.0022	.0021	
1,000	.....	.....	20.0000	.0022	

TEST WITH INTERIOR AND EXTERIOR PRESSURES AND LONGITUDINAL COMPRESSION COMBINED.

The tube now occupied a position the same as in the preceding test, i. e., rotated 180° from its position in the earlier tests.

LONGITUDINAL CONTRACTION.

Pressure per square inch.	Measurements of 20-inch longitudinal.				Remarks.
	W.	Successive differences.	E.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
11,000	19.9994	.....	.....	.....	
1,000	20.0000	.0006	20.0000	.....	
11,000	19.9994	.0006	19.9986	.0014	
1,000	20.0000	.0006	19.9997	.0011	
11,000	19.9995	.0005	19.9986	.0011	
1,000	20.0000	.0005	20.0000	.0014	
11,000	19.9994	.0006	19.9987	.0013	
1,000	20.0001	.0007	19.9999	.0012	
11,000	19.9994	.0007	19.9987	.0012	
1,000	20.0000	.0006	20.0000	.0013	
11,000	.....	.....	19.9987	.0013	
1,000	.....	.....	19.9999	.0012	
11,000	.....	.....	19.9987	.0012	
1,000	.....	.....	19.9998	.0011	

TEST WITH EXTERIOR PRESSURE AND LONGITUDINAL COMPRESSION COMBINED.

Holes $\frac{1}{8}''$ diameter were drilled, 10″ and 11″, respectively, from each end of the tube section, from the surface of the bore, to a depth of 1″.9 and 1″, respectively.

Test showing the diametrical contraction of the tube at the bore (*a*), at the middle of the thickness of the walls (*b*), and near the exterior cylindrical surface (*c*).

DIAMETRICAL CONTRACTION NEAR THE EXTERIOR CYLINDRICAL SURFACE.

Pressure per square inch.	Measurements over pins *c*.				Remarks.
	Diameter S.	Successive differences.	Diameter N.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
1,000	.....	.....	11.8000	.....	
11,000	11.7920	.....	11.7922	.0078	
1,000	11.8000	.0080	11.7997	.0075	
11,000	11.7920	.0080	11.7921	.0076	
1,000	11.8000	.0080	11.7997	.0076	
11,000	11.7929	.0080	11.7921	.0076	
1,000	11.8000	.0080	11.7997	.0076	

TEST WITH EXTERIOR PRESSURE AND LONGITUDINAL COMPRESSION COMBINED.

DIAMETRICAL CONTRACTION AT THE MIDDLE OF THE THICKNESS OF THE WALLS.

Pressure per square inch.	Measurements over pins *b*.				Remarks.
	Diameter S.	Successive differences.	Diameter N.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
1,000	10.0000	.....	10.0000	.....	Rested 1 hour between these two readings.
11,000	9.9917	.0083	9.9920	.0080	
1,000	10.0000	.0083	9.9999	.0079	
11,000	9.9917	.0083	9.9919	.0080	
1,000	10.0000	.0083	10.0001	.0082	
11,000	9.9917	.0083	9.9920	.0081	
1,000	10.0000	.0083	10.0000	.0080	
.....	.....	.....	9.9920	.0080	
.....	.....	.....	10.0000	.0080	

TEST WITH EXTERIOR PRESSURE AND LONGITUDINAL COMPRESSION COMBINED.

DIAMETRICAL CONTRACTION OF BORE AT POINTS *a*.

Pressure per square inch.	Measurements at points *a*.				Remarks.
	Diameter S.	Successive differences.	Diameter N.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
11,000	7.9909	.....	.....	.....	
1,000	8.0000	.0091	8.0000	.....	
11,000	7.9910	.0090	7.9913	.0087	
1,000	8.0000	.0090	8.0000	.0087	Rested 1 hour under the maximum load between these two readings.
11,000	7.9910	.0090	7.9914	.0086	
1,000	8.0000	.0090	8.0000	.0086	
11,000	7.9910	.0090	7.9914	.0086	
1,000	8.0000	.0090	8.0001	.0087	
.....	.....	.....	7.9914	.0087	
.....	.....	.....	8.0001	.0087	

TEST WITH EXTERIOR PRESSURE AND LONGITUDINAL COMPRESSION COMBINED.

Measurements at points a_1 on diameter 90° from points *a*, in same plane as longitudinal holes $\frac{1}{4}''$ by 12″ deep, used for determination of longitudinal strains.

The present measured diameter occupies a vertical position.

DIAMETRICAL CONTRACTION OF BORE AT POINTS a_1 12″ FROM ENDS OF TUBES.

Pressure per square inch.	Measurements of bore.				Remarks.
	Diameter N.	Successive differences.	Diameter S.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
1,000	8.0000	.....	8.0000	.....	
11,000	7.9909	.0091	7.9911	.0089	
1,000	8.0001	.0092	8.0001	.0090	
11,000	7.9910	.0091	7.9913	.0088	
1,000	8.0001	.0091	8.0002	.0089	
11,000	7.9911	.0090	7.9913	.0089	
1,000	8.0003	.0092	8.0003	.0090	

TEST WITH EXTERIOR PRESSURE AND LONGITUDINAL COMPRESSION COMBINED.

DIAMETRICAL CONTRACTION OF BORE AT NORTH END AGAIN MEASURED.

Pressure per square inch.	Measurements of bore.				Remarks.
	Diameter at points a_1.	Successive differences.	Diameter at points a.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
1 000	8.0000	.....	8.0000	.....	
11, 000	7.9908	.0092	7.9913	.0087	
1, 000	8.0003	.0095	7.9999	.0086	
11, 000	7.9910	.0093	7.9912	.0087	
1, 000	8.0003	.0093	7.9999	.0087.	
11, 000	7.9910	.0093	.....	.....	
1, 000	8.0004	.0094	.....	.....	
11, 000	7.9908	.0096	.....	.....	
1, 000	8.0001	.0093	.....	.....	
11, 000	7.0009	.0092	.....	.....	
1, 000	8.0002	.0093	.....	.....	

TEST WITH EXTERIOR PRESSURE.

DIAMETRICAL CONTRACTION OF BORE AT POINTS *a*.

Pressure per square inch.	Measurements at points *a*.				Remarks.
	Diameter S.	Successive differences.	Diameter N.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
1, 000	8.0000	.....	8.0000	.....	
10. 000	7.9919	.0081	7.9919	.0081	
1, 000	8.0001	.0082	8.0001	.0082	
10, 000	7.9919	.0082	7.9919	.0082	
1, 000	8.0001	.0082	8.0001	.0082	
10, 000	7.9919	.0082	7.9919	.0082	
1, 000	8.0002	.0083	8.0001	.0082	
10. 000	7.9920	.0082	.....	.....	
1, 000	8.0003	.0083	.....	.....	

TEST WITH EXTERIOR PRESSURE.

Measurements on vertical diameters at points a_1 in plane of $\frac{1}{4}''$ longitudinal holes.

DIAMETRICAL CONTRACTION OF BORE AT POINTS a_1 12″ FROM ENDS OF TUBE.

Pressure per square inch.	Measurements opposite points *a*.				Remarks.
	Diameter S.	Successive differences.	Diameter N.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
1, 000	8.0000	.....	8, 0000	.....	
10, 000	7.9916	.0084	7.9917	.0083	
1, 000	7.9999	.0083	7.9999	.0082	
10, 000	7.9916	.0083	7.9916	.0083	
1, 000	7.9999	.0083	7.9999	.0083	
.....	.....	.....	7.9916	.0083	
.....	.....	.....	7.9998	.0082	

TEST WITH EXTERIOR PRESSURE.

DIAMETRICAL CONTRACTION AT THE MIDDLE OF THE THICKNESS OF THE WALLS.

Pressure per square inch.	Measurements over pins *b*.				Remarks.
	Diameter S.	Successive differences.	Diameter N.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
1,000	10.0000	.....	10.0000	.....	
10,000	9.9920	.0080	9.9922	.0078	
1,000	10.0001	.0081	10.0001	.0079	
10,000	9.9920	.0081	9.9923	.0078	
1,000	10.0000	.0080	10.0003	.0080	
10,000	9.9920	.0080	9.9924	.0079	
1,000	10.0000	.0080	10.0004	.0080	
10,000	.....	.....	9.9925	.0079	
1,000	.....	.....	10.0005	.0080	
10,000	.....	.....	9.9925	.0080	
1,000	.....	.....	10.0005	.0080	

TEST WITH EXTERIOR PRESSURE.

DIAMETRICAL CONTRACTION NEAR THE EXTERIOR CYLINDRICAL SURFACE.

Pressure per square inch.	Measurements over pins *c*.				Remarks.
	Diameter S.	Successive differences.	Diameter N.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
1,000	11.8000	.....	11.8000	.....	
10,000	11.7918	.0082	11.7921	.0079	
1,000	11.7999	.0081	11.8001	.0080	
10,000	11.7918	.0081	11.7921	.0080	
1,000	11.7999	.0081	11.8000	.0079	
10,000	11.7918	.0081	11.7920	.0080	
1,000	11.7998	.0080	11.8001	.0081	

TEST WITH EXTERIOR PRESSURE AND LONGITUDINAL TENSION COMBINED.

DIAMETRICAL CONTRACTION OF BORE AT POINTS *a*.

Pressure per square inch.	Measurements at points *a*.				Remarks.
	Diameter S.	Successive differences.	Diameter N.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
1,000	8.0000	.....	8.0000	.....	
9,500	7.0015	.0085	7.9914	.0086	
1,000	7.9999	.0084	8.0000	.0086	
9,500	7.0015	.0084	7.9914	.0086	
1,000	7.9999	.0084	8.0000	.0086	
9,500	7.0016	.0083	7.9914	.0086	
1,000	8.0000	.0084	8.0000	.0086	

TEST WITH EXTERIOR PRESSURE AND LONGITUDINAL TENSION COMBINED.

Measurements on vertical diameters at points a_1 in plane of $\frac{1}{4}''$ longitudinal holes.

DIAMETRICAL CONTRACTION OF BORE AT POINTS a_1 12″ FROM ENDS OF TUBE.

Pressure per square inch.	Measurements at points a_1				Remarks.
	Diameter S.	Successive differences.	Diameter N.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
1,000	8.0000	.....	8.0000	.....	
9,500	7.9915	.0085	7.9914	.0086	
1,000	8.0000	.0085	8.0000	.0086	
9,500	7.9915	.0085	7.9915	.0085	
1,000	8.0001	.0086	8.0000	.0085	
9,500	7.9916	.0085	7.9915	.0085	
1,000	8.0002	.0086	8.0000	.0085	
9,500	7.9918	.0084	.....	.....	
1,000	8.0002	.0084	.....	.....	

TEST WITH EXTERIOR PRESSURE AND LONGITUDINAL TENSION COMBINED.

DIAMETRICAL CONTRACTION AT THE MIDDLE OF THE THICKNESS OF THE WALLS.

Pressure per square inch.	Measurements over pins b.				Remarks.
	Diameter S.	Successive differences.	Diameter N.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
1,000	10.0000	.....	10.0000	.....	
9,500	9.9917	.0083	9.9917	.0083	
1,000	10.0001	.0084	10.0001	.0084	
9,500	9.9918	.0083	9.9917	.0084	
1,000	10.0001	.0083	10.0001	.0084	
9,500	9.9918	.0083	9.9917	.0084	
1,000	10.0001	.0083	10.0001	.0084	

TEST WITH EXTERIOR PRESSURE AND LONGITUDINAL TENSION COMBINED.

DIAMETRICAL CONTRACTION NEAR THE EXTERIOR CYLINDRICAL SURFACE.

Pressure per square inch.	Measurements over pins c.				Remarks.
	Diameter S.	Successive differences.	Diameter N.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
1,000	11.8000	.....	11.8000	.....	
9,500	11.7916	.0084	11.7914	.0086	
1,000	11.8000	.0084	11.7999	.0085	
9,500	11.7915	.0085	11.7913	.0086	
1,000	11.7999	.0084	11.7999	.0086	
9,500	11.7914	.0085	11.7913	.0086	
1,000	11.7999	.0085	11.7999	.0086	
9,500	11.7915	.0084	11.7914	.0085	
1,000	11.8000	.0085	11.8000	.0086	

TEST WITH EXTERIOR PRESSURE AND LONGITUDINAL TENSION COMBINED.

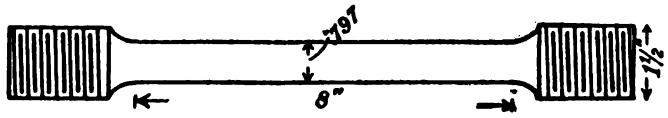
Diametrical contraction near the exterior cylindrical surface.

MEASUREMENTS AT NORTH END REPEATED.

Pressure per square inch.	Measurements over pins *c*.		Remarks.
	Diameter N.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	
1,000	11.8000	.....	
9,500	11.7912	.0088	
1,000	11.7998	.0086	
9,500	11.7910	.0088	
1,000	11.7997	.0087	
9,500	11.7910	.0087	
1,000	11.7997	.0087	
9,500	11.7911	.0086	
1,000	11.7996	.0085	

TENSILE TEST OF STEEL BAR FROM U. S. ENGINEER'S OFFICE, PORTLAND, ME.

No. 8745.



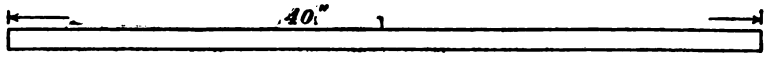
Diameter, ".797.
Sectional area, .499 square inch.
Elastic limit, 21,400 pounds = 42,880 pounds per square inch.
Tensile strength, 29,690 pounds = 59,500 pounds per square inch.
Elongation in 8 inches, 2".33 = 29.1 per cent.
Elongation of inch sections, ".18, ".23, ".23, ".26, ".30, ".65*, ".28, ".20.
Diameter at fracture, ".51; area, .204 square inch.
Contraction of area, 59.1 per cent.
Appearance of fracture, silky.

GAUTIER STEEL BARS.

CHEMICAL ANALYSIS OF 1¼-INCH BAR FROM SAME GRADE OF STEEL.

	Per cent.
Carbon	.161
Manganese	.606
Silicon	.042
Sulphur	.067
Phosphorus	.070
Copper	.025

HOT ROLLED BARS, UNFINISHED.



No. 9303.

Diameter, ".38.
Sectional area, .1134 square inch.
Gauged length, 10".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
113	1,000	0.	0.	Initial load.
567	5,000	.0013	.....	
1,134	10,000	.0031	.....	
1,701	15,000	.0049	.....	
2,268	20,000	.0065	.....	
2,835	25,000	.0080	.....	
2,948	26,000	.0085	.....	
3,062	27,000	.0089	.....	
3,175	28,000	.0091	.....	
3,289	29,000	.0096	.....	
3,402	30,000	.0099	0.	
3,515	31,000	.0103	.....	
3,629	32,000	.0107	.....	
3,742	33,000	.0109	.....	
3,855	34,000	.0111	.....	
3,969	35,000	.0116	.....	
4,082	36,000	.0119	.....	
4,196	37,000	.0122	.....	
4,309	38,000	.0127	.....	
4,422	39,000	.0130	.....	
4,536	40,000	.0133	.0001	
4,649	41,000	.0137	.....	
4,763	42,000	.0141	.....	
4,876	43,000	.0145	.....	
4,989	44,000	.0149	.....	
5,103	45,000	.0152	.....	
5,160	45,500	.0154	.....	Elastic limit.
		.1000	.....	
5,216	46,000	.2140	.....	
5,329	47,000	.3300	.....	
5,443	48,000	.51	.....	
5,556	49,000	.53	.....	
5,670	50,000	.57	.....	
6,802	59,980	2.50	.....	Tensile strength.

Elongation in 10 inches, 2".64=26.4 per cent.
Elongation of inch sections, ".20, ".20, ".22, ".27, ".26, ".28, ".52*, ".26, ".23, ".20.
Diameter at fracture, ".22; area, .0380 square inch.
Contraction of area, 66.5 per cent.
Appearance of fracture, fine silky. Cup shaped.

DUPLICATE OF No. 9303.

No. 9304.

Diameter, ″.38.
Sectional area, .1134 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
113	1,000	0.	0.	Initial load.
567	5,000	.0015	.....	
1,134	10,000	.0032	.....	
2,268	20,000	.0067	.....	
3,402	30,000	.0100	0.	
3,969	35,000	.0118	.....	
4,536	40,000	.0137	.0001	
4,649	41,000	.0140	.....	
4,763	42,000	.0143	.....	
4,876	43,000	.0147	.....	
4,989	44,000	.0150	.....	
5,103	45,000	.0154	.0001	
5,103	45,000	.4300	.....	Second application of load. Rapid stretching began at the jaws and gradually extended throughout the length of the specimen.
5,216	46,000	.45	.....	
5,443	48,000	.52	.....	
5,670	50,000	.62	.....	
5,897	52,000	.74	.....	
6,123	54,000	.90	.....	
6,350	56,000	1.13	.....	
6,577	58,000	1.58	.....	
6,740	59,440	2.34	.....	Tensile strength.

Elongation in 10 inches, 2″.66=26.6 per cent.
Elongation of inch sections, ″.20, ″.20, ″.22, ″.24, ″.52*, ″.32, ″.28, ″.24, ″.23, ″.21.
Diameter at fracture, ″.22; area, .0380 square inch.
Contraction of area, 66.5 per cent.
Appearance of fracture, fine silky. Cup shaped.

No. 9305.

Diameter, ″.75.
Sectional area, .442 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
442	1,000	0.	0.	Initial load.
2,210	5,000	.0013	.....	
4,420	10,000	.0029	.....	
8,840	20,000	.0062	.....	
13,260	30,000	.0100	.0007	
15,470	35,000	.0118	.....	
17,680	40,000	.0134	.0004	..... Rapid stretching began at jaws,
18,122	41,000	.0132	.....	..... gradually extending to the
18,564	42,000	.0130	.....	Elastic limit gauged length.
		.3450	.....	
19,006	43,000	.3765	.....	
19,448	44,000	.3890	.3738	
20,332	46,000	.40	.....	
21,216	48,000	.55	.....	
22,100	50,000	.66	.....	
22,984	52,000	.79	.....	
23,868	54,000	1.02	.....	
24,752	56,000	1.36	.....	
25,510	57,710	2.50	.....	Tensile strength.

Elongation in 10-inches, 3″.01=30.1 per cent.
Elongation of inch sections, ″.30, ″.69*, ″.29, ″.27, ″.25, ″.26, ″.26, .24, ″.21.
Diameter at fracture, ″.43; area, .145 square inch.
Contraction of area, 67.2 per cent.
Appearance of fracture, fine silky. Cup shaped.

No. 9306.

Diameter, 1″.26.
Sectional area, 1.247 square inches.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,247	1,000	0.	0.	Initial load.
6,235	5,000	.0014	.....	
12,470	10,000	.0032	.....	
24,940	20,000	.0068	.....	
37,410	30,000	.0109	.0008	
43,645	35,000	.0133	.0016	
44,892	36,000	.0140	.....	
46,139	37,000	.0145	.....	
47,386	38,000	.0149	.....	
48,633	39,000	.0152	.....	
49,880	40,000	.0159	.0025	Elastic limit.
51,127	41,000	.0170	.....	
52,374	42,000	.0225	.....	
53,621	43,000	.2590	.....	
54,868	44,000	.2800	.....	
57,362	46,000	.35	.....	
59,856	48,000	.41	.....	
62,350	50,000	.49	.....	
64,844	52,000	.58	.....	
67,338	54,000	.70	.....	
69,832	56,000	.88	.....	
72,326	58,000	1.09	.....	
74,820	60,000	1.50	.....	
75,700	60,710	2.03	.....	Tensile strength.

Elongation in 10 inches, 3″.47=34.7 per cent.
Elongation of inch sections, ″.24, ″.27, ″.33, ″.79*, ″.38, ″.30, ″28, ″.28, ″.30, ″.30.
Diameter at fracture, ″.78; area, .478 square inch.
Contraction of area, 61.7 per cent.
Appearance of fracture, fine silky. Cup shaped.

TURNED SHAFT PREPARED FOR ENDURANCE TEST.

No. 9307.

Marks, 1 c 5.
Diameter, 1″.00.
Sectional area, .7854 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
785	1,000	0.	0.	Initial load.
3,927	5,000	.0013	.....	
7,854	10,000	.0060	.....	
15,708	20,000	.0063	.....	
23,562	30,000	.0100	.0002	
27,489	35,000	.0119	.....	
28,274	36,000	.0122	.....	
29,060	37,000	.0127	.....	
29,845	38,000	.0130	.....	
30,631	39,000	.0134	.....	
31,416	40,000	.0138	.0007	
32,201	41,000	.0139	.....	Elastic limit.
32,987	42,000	.0148	.....	
33,772	43,000	.2722	.....	
34,558	44,000	.2749	.....	
35,343	45,000	.3000	.....	
37,699	48,000	.40	.....	
39,270	50,000	.47	.....	
40,841	52,000	.55	.....	
42,412	54,000	.67	.....	
43,983	56,000	.82	.....	
45,553	58,000	1.00	.....	
47,124	60,000	1.34	.....	
48,420	61,650	2.18	.....	Tensile strength.

Elongation in 10 inches, 2″.86=28.6 per cent.
Elongation of inch sections, ″.21, ″.21, ″.22, ″.23, ″.31, ″.71*, ″.27, ″.24, ″.23, ″.23.
Diameter at fracture, ″.62; area, .3019 square inch.
Contraction of area, 61.6 per cent.
Appearance of fracture, fine silky. Cup shaped.

CAST IRON

FROM

WATERTOWN ARSENAL FOUNDRY,

AND

PIG IRONS.

CAST IRON FROM WATERTOWN ARSENAL FOUNDRY.

The specimens of cast iron were taken from cylinders 18 inches long by 8 inches diameter, cored 3½ inches in diameter, poured from the same metal as the castings they represented.

Specimens of pig iron were turned down directly from sample pigs.

The furnace charges were as follows:

The heads referred to in the furnace charges were heads of shell from previous casts.

The scrap iron used was old shot and shell, bolsters, and gun-carriage scrap of good quality.

Date of cast.	Furnace charge.	Pounds.	Furnace.	No. of tension test.
June 25, 1896	Salisbury pig No. 4, high	2,000	Cupola	5367
	Salisbury pig No. 4, low	1,500		
	Heads	4,200		
	10-inch shell	3,000		
	Scrap	3,500		
	Total	14,200		
July 6, 1896	Salisbury pig No. 4, high	3,000	Cupola	5369
	Salisbury pig No. 4, low	3,000		
	Heads	3,500		
	10-inch shell	3,500		
	Scrap	4,000		
	Total	17,000		
July 13, 1896	Salisbury pig No. 4, high	3,500	Cupola	5372
	Salisbury pig No. 4, low	3,500		
	Soft pig	2,000		
	Heads	4,000		
	10-inch shell	3,500		
	Scrap	11,500		
	Total	28,000		
July 20, 1896	Salisbury pig No. 4, high	3,500	Cupola	5373
	Salisbury pig No. 4, low	3,500		
	Soft pig	2,000		
	Heads	4,300		
	10-inch shell	3,500		
	Scrap	11,200		
	Total	28,000		
July 27, 1896	Salisbury pig No. 4, high	3,500	Cupola	5374
	Salisbury pig No. 4, low	3,500		
	Soft pig	1,000		
	Heads	4,300		
	10-inch shell	3,000		
	Scrap	9,700		
	Total	25,000		
August 6, 1896	Salisbury pig No. 4, high	3,500	Cupola	5375
	Salisbury pig No. 4, low	3,500		
	Soft pig	1,000		
	Heads	4,300		
	10-inch shot	3,500		
	Scrap	6,500		
	Total	22,300		
August 20, 1896	Salisbury pig No. 4, high	1,500	Cupola	5378
	Salisbury pig No. 4, low	1,000		
	Heads	4,300		
	10-inch shell	3,500		
	Scrap	6,700		
	Total	17,000		

Cast iron from Watertown Arsenal Foundry—Continued.

Date of cast.	Furnace charge.	Pounds.	Furnace.	No. of tension test.
September 1, 1896	Salisbury pig No. 4, high	1,500	Cupola	5380
	Salisbury pig No. 4, low	1,500		
	Soft pig	1,000		
	Heads	3,500		
	Scrap	8,500		
	Total	16,000		
September 8, 1896	Salisbury pig No. 4, high	3,000	Cupola	5382
	Salisbury pig No. 4, low	3,500		
	Heads	3,000		
	Scrap	9,500		
	Total	19,000		
October 2, 1896	Salisbury pig No. 4, high	800	Cupola	5385
	Salisbury pig No. 4, low	700		
	Soft pig	1,000		
	Heads	2,000		
	Scrap	5,500		
	Total	10,000		
October 9, 1896	Salisbury pig No. 4, high	700	Cupola	5386
	Soft pig	1,000		
	Heads	3,500		
	Scrap	4,800		
	Total	10,000		
October 21, 1896	Salisbury pig No. 4, high	1,500	Cupola	5388
	Salisbury pig No. 4, low	1,500		
	Soft pig	2,000		
	Heads	2,000		
	Scrap	9,000		
	Total	16,000		
October 27, 1896	Salisbury pig No. 4, high	700	Cupola	5389
	Soft pig	2,000		
	Heads	2,500		
	Scrap	8,800		
	Total	14,000		
November 4, 1896	Salisbury pig No. 4, high	700	Cupola	5390
	Soft pig	2,000		
	Heads	3,000		
	Scrap	8,300		
	Total	14,000		
November 11, 1896	Salisbury pig No. 4, high	700	Cupola	5392
	Soft pig	2,000		
	Heads	3,000		
	Scrap	6,300		
	Total	12,000		
November 21, 1896	Salisbury pig No. 4, high	2,000	Cupola	5400
	Soft pig	2,000		
	Heads	3,800		
	Scrap	5,200		
	Total	13,000		
December 8, 1896	Salisbury pig No. 4, high	2,700	Cupola	5402
	Soft pig	2,000		
	Heads	4,300		
	Scrap	3,000		
	Total	12,000		
January 2, 1897	Salisbury pig No. 4, high	2,700	Cupola	5407
	Soft pig	2,000		
	Heads	4,300		
	Scrap	2,000		
	Total	11,000		

Cast iron from Watertown Arsenal Foundry—Continued.

Date of cast.	Furnace charge.	Pounds.	Furnace.	No. of tension test.
January 15, 1897	Salisbury pig	3,500	Cupola	5409
	Soft pig	1,000		
	Heads	3,800		
	Scrap	4,000		
	Total	12,300		
February 25, 1897	Muirkirk pig	2,000	Air furnace	5431
	Salisbury pig	2,000		
	Rebecca pig	2,000		
	Scrap	6,000		
	Total	12,000		
	Salisbury pig	6,000	Cupola	
	Heads	3,500		
	Scrap	2,500		
	Total	12,000		
March 12, 1897	Salisbury pig	5,000	Cupola	5442
	Soft pig	2,000		
	Heads	3,000		
	Scrap	2,000		
	Total	12,000		
April 3, 1897	Muirkirk pig	5,000	Cupola	5452
	Salisbury pig	4,500		
	Soft pig	2,000		
	Heads	4,300		
	Scrap	8,200		
	Total	24,000		
April 23, 1897	Muirkirk pig	2,000	Cupola	5455
	Salisbury pig	8,000		
	Heads	4,300		
	Scrap	9,700		
	Total	24,000		
May 3, 1897	Muirkirk pig	2,000	Cupola	5462
	Salisbury pig	7,000		
	Rebecca pig	2,000		
	Heads	3,300		
	Scrap	5,700		
	Total	20,000		
May 26, 1897	Salisbury pig	4,000	Cupola	5466
	Soft pig	1,000		
	Heads	3,800		
	Scrap	3,200		
	Total	12,000		
July 1, 1896	Muirkirk pig No. 4, high	5,000	Air furnace	5368
	Salisbury pig No. 4, high	2,000		
	Salisbury pig No. 4, low	2,000		
	Soft pig	3,000		
	Remelted pig	500		
	Total	12,500		
	Muirkirk pig No. 4, high	1,000	Cupola	
	Salisbury pig No. 4, high	1,500		
	Salisbury pig No. 4, low	1,500		
	Heads	4,200		
	10-inch shell	1,800		
	Total	10,000		

Cast iron from Watertown Arsenal Foundry—Continued.

Date of cast.	Furnace charge.	Pounds.	Furnace.	No. of tension test.
August 27, 1896	Muirkirk pig No. 4, high	5,000	Air furnace	5379
	Salisbury pig No. 4, high	2,000		
	Salisbury pig No. 4, low	2,000		
	Soft pig	3,000		
	Remelted pig	500		
	Total	12,500		
	Muirkirk pig No. 4, high	1,000	Cupola	
	Salisbury pig No. 4, high	1,500		
	Salisbury pig No. 4, low	2,000		
	Heads	3,000		
	Scrap	7,000		
	Total	14,500		
January 22, 1897	Muirkirk pig	5,000	Air furnace	5420
	Salisbury pig No. 4, high	2,000		
	Salisbury pig No. 4, low	2,000		
	Soft pig	3,000		
	Remelted pig	500		
	Total	12,500		
	Salisbury pig No. 4, high	1,500	Cupola	
	Salisbury pig No. 4, low	1,500		
	Muirkirk pig	1,500		
	Heads	3,800		
	Scrap	1,700		
	Total	10,000		
February 18, 1897	Muirkirk pig	5,000	Air furnace	5430
	Salisbury pig	4,000		
	Rebecca pig	3,000		
	Remelted pig	500		
	Total	12,500		
	Salisbury pig	3,000	Cupola	
	Muirkirk pig	1,500		
	Heads	3,000		
	Scrap	2,500		
	Total	10,000		
March 13, 1897	Muirkirk pig	5,250	Air furnace	5443
	Salisbury pig	4,000		
	Rebecca pig	3,250		
	Scrap	500		
	Total	13,000		
	Muirkirk pig	2,000	Cupola	
	Salisbury pig	3,500		
	Heads	3,000		
	Scrap	3,000		
	Total	11,500		
March 31, 1897	Muirkirk pig	5,550	Air furnace	5448
	Salisbury pig	3,400		
	Salisbury pig No. 1	300		
	Rebecca pig	3,250		
	Remelted pig	500		
	Total	13,000		
	Muirkirk pig	3,000	Cupola	
	Salisbury pig	4,000		
	Rebecca pig	2,000		
	Heads	4,300		
	Scrap	6,700		
	Total	20,000		

Cast iron from Watertown Arsenal Foundry—Continued.

Date of cast.	Furnace charge.	Pounds.	Furnace.	No. of tension test.
April 14, 1897	Muirkirk pig	4,500	Air furnace	5453
	Salisbury pig No. 4	2,000		
	Salisbury pig No. 3	1,000		
	Rebecca pig	2,000		
	Total	9,500		
	Salisbury pig	3,500	Cupola	
	Soft pig	1,000		
	Heads	3,800		
	Scrap	3,000		
	Total	11,300		
April 29, 1897	Muirkirk pig	4,500	Air furnace	5456
	Salisbury pig No. 4	2,000		
	Salisbury pig No. 3	1,000		
	Rebecca pig	2,000		
	Total	9,500		
	Salisbury pig	4,000	Cupola	
	Rebecca pig	2,000		
	Heads	4,300		
	Scrap	3,000		
	Total	13,300		
May 20, 1897	Muirkirk pig	4,500	Air furnace	5464
	Salisbury pig No. 4	2,000		
	Salisbury pig No. 3	1,000		
	Rebecca pig	2,000		
	Total	9,500		
	Salisbury pig	1,500	Cupola	
	Soft pig	1,000		
	Heads	3,800		
	Scrap	1,500		
	Total	7,800		
June 9, 1897	Muirkirk pig	4,500	Air furnace	5469
	Salisbury pig No. 4	2,000		
	Salisbury pig No. 3	1,000		
	Rebecca pig	2,000		
	Total	9,500		
	Salisbury pig	4,500	Cupola	
	Rebecca pig	2,000		
	Heads	3,800		
	Scrap	2,000		
	Total	12,300		
September 25, 1896	Muirkirk pig	8,000	Cupola	5383
	Salisbury pig No. 4, high	4,000		
	Salisbury pig No. 4, low	4,000		
	Heads	4,300		
	Scrap	3,500		
	Total	23,800		
	Muirkirk pig No. 4, high	12,000	Air furnace	5384
	Salisbury pig No. 4, high	2,000		
	Salisbury pig No. 4, low	2,000		
	Rebecca pig	2,000		
	Total	18,000		

Cast iron from Watertown Arsenal Foundry—Continued.

Date of cast.	Furnace charge.	Pounds.	Furnace.	No. of tension test.
December 4, 1896	Muirkirk pig No. 4, high	6,700	Air furnace	5401
	Salisbury pig No. 4, high	3,400		
	Salisbury pig No. 4, low	3,300		
	Rebecca pig	6,600		
	Total	20,000		
	Muirkirk pig No. 4, high	2,000	Cupola	
	Salisbury pig No. 4, high	3,000		
	Salisbury pig No. 4, low	3,000		
	Soft pig	2,000		
	Heads	4,300		
	Scrap	7,000		
	Total	21,300		
December 29, 1896	Muirkirk pig No. 4, high	6,000	Air furnace	5401
	Salisbury pig No. 4, high	3,400		
	Salisbury pig No. 4, low	3,300		
	Rebecca pig	6,300		
	Total	19,000		
	Muirkirk pig No. 4, high	2,000	Cupola	
	Salisbury pig No. 4, high	3,000		
	Salisbury pig No. 4, low	3,000		
	Soft pig	2,000		
	Heads	4,300		
	Scrap	3,000		
	Total	17,300		
July 6, 1896	Salisbury pig No. 4, high	3,000	Cupola	5369
	Salisbury pig No. 4, low	3,000		
	Heads	3,500		
	10-inch shell	3,500		
	Scrap	4,000		
	Total	17,000		
July 13, 1896	Salisbury pig No. 4, high	3,500	Cupola	5372
	Salisbury pig No. 4, low	3,500		
	Soft pig	2,000		
	Heads	4,000		
	10-inch shell	3,500		
	Scrap	11,500		
	Total	28,000		
July 20, 1896	Salisbury pig No. 4, high	3,500	Cupola	5373
	Salisbury pig No. 4, low	3,500		
	Soft pig	2,000		
	Heads	4,300		
	10-inch shell	3,500		
	Scrap	11,200		
	Total	28,000		
July 27, 1896	Salisbury pig No. 4, high	3,500	Cupola	5374
	Salisbury pig No. 4, low	3,500		
	Soft pig	1,000		
	Heads	4,300		
	10-inch shell	3,000		
	Scrap	9,700		
	Total	25,000		

Cast iron from Watertown Arsenal Foundry—Continued.

Date of cast.	Furnace charge.	Pounds.	Furnace.	No. of tension test.
November 18, 1896	Muirkirk pig No. 4, high	6,000	Air furnace	5393
	Salisbury pig No. 4, high	3,000		
	Salisbury pig No. 4, low	3,000		
	Rebecca pig	6,000		
	Total	18,000		
	Muirkirk pig No. 4, high	2,000	Cupola	
	Salisbury pig	2,000		
	Soft pig	2,000		
	Heads	3,500		
	Scrap	6,500		
	Total	16,000		
December 17, 1896	Muirkirk pig No. 4, high	5,000	Air furnace	5403
	Salisbury pig No. 4, high	2,000		
	Salisbury pig No. 4, low	2,700		
	Rebecca pig	5,700		
	Total	16,000		
	Muirkirk pig	2,000	Cupola	
	Salisbury pig	4,000		
	Soft pig	2,000		
	Scrap	6,000		
	Total	14,000		
April 20, 1897	Muirkirk pig	6,000	Air furnace	5454
	Salisbury pig No. 4	3,500		
	Salisbury pig No. 3	3,000		
	Rebecca pig	3,500		
	Total	16,000		
	Muirkirk pig	2,000	Cupola	
	Salisbury pig	9,000		
	Soft pig	2,000		
	Heads	4,300		
	Scrap	8,700		
	Total	26,000		
May 12, 1897	Muirkirk pig	6,000	Air furnace	5463
	Salisbury pig No. 4	3,500		
	Salisbury pig No. 3	3,000		
	Rebecca pig	3,500		
	Total	16,000		
	Muirkirk pig	2,000	Cupola	
	Salisbury pig No. 4	6,000		
	Heads	2,800		
	Scrap	2,000		
	Total	12,800		
June 2, 1897	Muirkirk pig	6,000	Air furnace	5467
	Salisbury pig No. 4	3,500		
	Salisbury pig No. 3	3,000		
	Rebecca pig	3,500		
	Total	16,000		
	Muirkirk pig	2,000	Cupola	
	Salisbury pig	6,000		
	Heads	3,800		
	Scrap	3,000		
	Total	14,800		

Cast iron from Watertown Arsenal Foundry—Continued.

Date of cast.	Furnace charge.	Pounds.	Furnace.	No. of tension test.
September 11, 1896	Muirkirk pig No. 4, high	8,000	Air furnace	5381
	Salisbury pig No. 4, high	4,000		
	Salisbury pig No. 4, low	3,000		
	Soft pig	5,000		
	Remelted pig	10,000		
	Total	30,000		
	Muirkirk pig No. 4, high	2,000	Cupola	
	Salisbury pig No. 4, high	10,000		
	Soft pig	2,000		
	Heads	3,500		
	Scrap	2,000		
	Total	19,500		
October 14, 1896	Muirkirk pig	8,000	Air furnace	5387
	Salisbury pig No. 4, high	4,000		
	Salisbury pig No. 4, low	3,000		
	Soft pig	5,000		
	Remelted pig	10,000		
	Total	30,000		
	Muirkirk pig	2,000	Cupola	
	Salisbury pig No. 4, high	6,000		
	Salisbury pig No. 4, low	4,000		
	Soft pig	2,000		
	Heads	3,000		
	Scrap	3,000		
	Total	20,000		
January 13, 1897	Muirkirk pig	8,000	Air furnace	5408
	Salisbury pig No. 4, high	4,000		
	Salisbury pig No. 4, low	3,000		
	Rebecca pig	5,000		
	Remelted pig	10,000		
	Total	30,000		
	Muirkirk pig	2,000	Cupola	
	Salisbury pig No. 4, high	6,000		
	Salisbury pig No. 4, low	4,000		
	Soft pig	2,000		
	Heads	3,000		
	Scrap	3,000		
	Total	20,000		
February 9, 1897	Muirkirk pig	8,000	Air furnace	5424
	Salisbury pig	7,000		
	Soft pig	5,000		
	Remelted pig	10,000		
	Total	30,000		
	Muirkirk pig	2,000	Cupola	
	Salisbury pig	8,000		
	Soft pig	2,000		
	Heads	3,000		
	Scrap	4,000		
	Total	19,000		

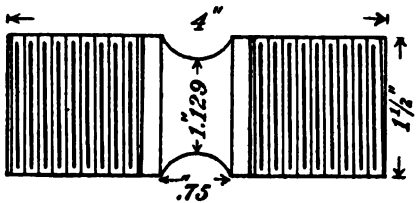
Cast iron from Watertown Arsenal Foundry—Continued.

Date of cast.	Furnace charge.	Pounds.	Furnace.	No. of tension test.
	Muirkirk pig No. 4, high	6,000		
	Salisbury pig No. 4, high	2,800		
	Salisbury pig No. 4, low	2,700		
	Soft pig	5,500	Air furnace	
	Remelted pig	5,000		
	Total	22,000		
August 13, 1897	Muirkirk pig No. 4, high	3,000		5376
	Salisbury pig No. 4, high	2,000		
	Salisbury pig No. 4, low	2,000		
	Heads	3,800	Cupola	
	10-inch shot	2,000		
	Scrap	2,900		
	Total	15,700		
January 26, 1897	Muirkirk pig	2,500		5421
	Salisbury pig No. 4, high	3,500		
	Salisbury pig No. 4, low	3,500		
	Rebecca pig	2,000		
	Heads	4,300	Cupola	
	Scrap	8,200		
	Total	24,000		
February 16, 1897	Muirkirk pig	3,000		5429
	Salisbury pig	7,000		
	Soft pig	2,000		
	Heads	3,500	Cupola	
	Scrap	9,000		
	Total	24,500		
February 25, 1897	Muirkirk pig	2,000		5431
	Salisbury pig	2,000		
	Rebecca pig	2,000		
	Scrap	6,000	Air furnace	
	Total	12,000		
	Salisbury pig	6,000		
	Heads	3,500		
	Scrap	2,500	Cupola	
	Total	12,000		
March 8, 1897	Muirkirk pig	2,500		5439
	Salisbury pig	2,500		
	Rebecca pig	2,000		
	Scrap	6,000	Air furnace	
	Total	13,000		
	Muirkirk pig	1,000		
	Salisbury pig	4,000		
	Heads	3,000		
	Scrap	5,000	Cupola	
	Total	13,000		
March 17, 1897	Muirkirk pig	2,750		5444
	Salisbury pig	2,500		
	Rebecca pig	2,250		
	Scrap	5,500	Air furnace	
	Total	13,000		
	Muirkirk pig	1,000		5445
	Salisbury pig	5,000		
	Heads	3,000		
	Scrap	7,000	Cupola	
	Total	16,000		

Cast iron from Watertown Arsenal Foundry—Continued.

Date of cast.	Furnace charge.	Pounds.	Furnace.	No. of tension test.
March 24, 1897	Muirkirk pig	5,000	Cupola	5446
	Salisbury pig	4,500		
	Heads	4,300		
	Scrap	7,200		
	Total	21,000		
April 3, 1897	Muirkirk pig	5,000	Cupola	5452
	Salisbury pig	4,500		
	Soft pig	2,000		
	Heads	4,300		
	Scrap	8,200		
	Total	24,000		
April 23, 1897	Muirkirk pig	2,000	Cupola	5455
	Salisbury pig	8,000		
	Heads	4,300		
	Scrap	9,700		
	Total	24,000		
May 3, 1897	Muirkirk pig	2,000	Cupola	5462
	Salisbury pig	7,000		
	Rebecca pig	2,000		
	Heads	3,300		
	Scrap	5,700		
	Total	20,000		
August 6, 1896	Salisbury pig No. 4, high	3,500	Cupola	5375
	Salisbury pig No. 4, low	3,500		
	Soft pig	1,000		
	Heads	7,800		
	Scrap	6,500		
	Total	22,300		
January 15, 1897	Salisbury pig	3,500	Cupola	5409
	Soft pig	1,000		
	Heads	3,800		
	Scrap	4,000		
	Total	12,300		
March 4, 1897	Muirkirk pig	2,500	Air furnace	5438
	Salisbury pig	2,500		
	Rebecca pig	2,000		
	Scrap	6,000		
	Total	13,000		
	Muirkirk pig	1,000	Cupola	
	Salisbury pig	5,300		
	Heads	3,000		
	Scrap	3,700		
	Total	13,000		

CHEMICAL ANALYSES AND TENSION TESTS.



CAST IRON FROM WATERTOWN ARSENAL FOUNDRY.

No. of test.	Description.	Date of cast.	Chemical composition.								Tensile strength per square inch.	Fracture.	Specific gravity.
			Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.			
			Total.	Graphitic.	Combined.								
		1896.									*Pounds.*		
5367	12″ shell and 10″ shot	June 25									31,010	Fine granular, granitic	7.2152
5369	8″ and 10″ shot	July 6									29,890	....do	7.1587
5372	12″ shell and 8″ shot	July 13									32,480	Fine granular, light gray, granitic	7.1943
5373	12″ shell and 10″ shot	July 20									31,120	....do	7.2406
5374	12″ shell and 8″ shot	July 27									31,720	Fine granular, granitic	7.1710
5375	12″ shell, 8″ and 10″ shot	Aug. 6									31,480	....do	7.2361
5378	8″ and 10″ shot	Aug. 20									29,710	....do	7.1805
5380	do	Sept. 1									31,580	Fine granular, light gray, granitic	7.2100
5382	8″ and 10″ shot and 12″ shell	Sept. 8									30,800	....do	7.1705
5385	5″ shell	Oct. 2									31,100	Fine granular, mottled	7.2376
5386	....do	Oct. 9	3.413	1.968	0.445	0.592	0.810	0.110	0.326		30,420	....do	7.2286
5388	....do	Oct. 21									30,010	....do	7.1983
5389	....do	Oct. 27									30,020	....do	7.1698
5390	....do	Nov. 4									30,400	....do	7.1892
5392	....do	Nov. 11									31,460	Fine granular, granitic	7.2275
5400	5″ and 12″ shell	Nov. 21									30,200	Fine granular, light gray	7.1907
5402	....do	Dec. 8									30,710	Fine granular, light gray, granitic	7.1844

Cast iron from Watertown Arsenal Foundry—Continued.

No. of test.	Description.	Date of cast.	Chemical composition.								Tensile strength per square inch.	Fracture.	Specific gravity.
			Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.			
			Total.	Graphitic.	Combined.								
		1897.									*Pounds.*		
5407	12″ shell	Jan. 2									30,990	Fine granular, light gray	7.1573
5409	12″ shell and 10″ shot	Jan 15									32,200	....do	7.1993
5431	8″ shot	Feb. 25									33,560	....do	7.2536
5442	10″ shot	Mar. 12									28,700	Fine granular, gray	7.1795
5452	10″ shot and 12″ shell	Apr. 3									30,510	Fine granular, light gray, mottled	7.2682
5455	....do	Apr. 23									32,250	....do	7.2286
4462	....do	May 3									33,390	....do	7.1619
5466	....do	May 26									31,980	....do	7.2245
		1896.											
5368	10″ top disappearing carriage	July 1									35,150	Fine granular, light gray	7.2169
5379	....do	Aug. 27									36,190	....do	7.2110
		1897.											
5420	....do	Jan. 22									35,720	....do	7.2543
5430	....do	Feb. 18									35,700	....do	7.2640
5443	....do	Mar. 13	2.598	2.044	0.554	0.662	0.500	0.140	0.427		35,870	....do	7.2366
5448	....do	Mar. 31	3.082	2.195	0.887	0.455	1.130	0.132	0.232		36,700	Fine granular, light silvery, gray	7.2024
5453	8″ top disappearing carriage	Apr. 14	2.879	2.107	0.772	0.440	1.165	0.080	0.184		35,320	Fine granular, light gray, dark gray in part	7.2284
5456	....do	Apr. 29									36,620	Fine granular, light gray, darker on one side	7.2148
5464	....do	May 20									33,320	Fine granular, light gray	7.1954
5469	....do	June 9									36,740	Fine granular, gray	7.3118
		1896.											
5383	Side frame 12″ disappearing carriage.	Sept. 25	3.136	2.623	0.513	0.462	1.109	0.118	0.285		31,350	Fine granular, mottled	7.2381
5384	....do	Sept. 25	2.890	2.017	0.873	0.617	0.550	0.144	0.277		29,200	Fine granular, mottled	7.3218
5401	....do	Dec. 4									36,890	Fine granular, light gray	7.2074
5404	....do	Dec. 29									35,120	Fine granular, light gray, mottled	7.1801
5369	Side frame, 12″ mortar carriage.	July 6									29,890	Fine granular, granitic	7.1587
5372	....do	July 13									32,480	Fine granular, light gray, granitic	7.1943
5373	....do	July 20									31,120	....do	7.2406
5374	....do	July 27									31,720	Fine granular, granitic	7.1710
5398	Bottom roller path, 12″ disappearing carriage.	Nov. 18									34,680	Fine granular, light gray	7.2022
5403	....do	Dec. 17									35,980	....do	7.2458
		1897.											
5454	....do	Apr. 20									36,550	Fine granular, gray	7.2289
5463	....do	May 12									36,360	Fine granular, light gray, mottled	7.2231

5467	.....do	June 2 1896.								31,020	.....do	7.1197
5381	Bottom roller path, 12″ barbette carriage.	Sept. 11								31,460	Fine granular, spongy at one side	7.2303
5387	.....do	Oct. 14 1897.	2.435	1.854	0.581	0.550	0.840	0.085	0.306	33,900	Fine granular, light gray	7.2277
5408	.....do	Jan. 13								33,300	.....do	7.2627
5424	.....do	Feb. 9 1896.								34,400	.....do	7.2452
5376	Upper roller path, 12″ mortar carriage.	Aug. 13 1897.								34,100	Fine granular, light gray	7.2865
5421	Bottom roller path, 10″ disappearing carriage.	Jan. 26								28,200	Fine granular, mottled	7.1741
5429	.....do	Feb. 16								31,050	.....do	7.2377
5431	.....do	Feb. 25								33,560	Fine granular, light gray	7.2536
5439	.....do	Mar. 8								30,550	.....do	7.2451
5444	.....do	Mar. 17								26,480	Fine granular, gray	7.2659
5445	.....do	.....do								27,310	Fine granular, light gray	7.2731
5446	Bottom roller path, 8″ disappearing carriage.	Mar. 24								31,990	.....do	7.1777
5452	.....do	Apr. 3								30,510	.....do	7.2682
5455	.....do	Apr. 23								32,250	Fine granular, light gray, mottled	7.2286
5462	.....do	May 3 1896.								33,390	.....do	7.1619
5375	Spring cylinder, extension, and transom, 12″ mortar carriage.	Aug. 6 1897.								31,480	Fine granular, granitic	7.2361
5409	Traverse circle, 10″ disappearing carriage.	Jan. 15								32,200	Fine granular, light gray	7.1993
5438	Base and drop of drop hammer.	Mar. 4								33,120	.....do	7.2902

PIG IRONS.

No. of test.	Description	Chemical composition.								Tensile strength per square inch.	Fracture.	Specific gravity.
		Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.			
		Total.	Graphitic.	Combined.								
										Pounds.		
5370	Muirkirk pig, No. 4, high									42,910	Very fine granular, light gray	7.2896
5371	....do	2.931	2.358	0.573	0.654	0.700	0.085	0.340		43,600	....do	7.2863
5433	....do									28,530	Fine granular, dark gray	7.2188
5436	....do									35,950	....do	7.2346
5377	Rebecca soft pig, No. 1	3.230	2.590	0.640	0.658	2.225	0.016	0.179		17,120	Granular, varying from coarse to fine. Brilliant luster.	6.9942
	Salisbury pig from Chatham, N. Y.:											
5405	No. 4	3.108	2.536	0.572	0.552	0.940	0.070	0.311		25,320	Fine granular, gray	7.1550
5406	No. 4, high	2.946	2.416	0.530	0.532	0.600	0.100	0.306		31,300	....do	7.2529
	Salisbury pig from Lime Rock, Conn.:											
5440	No. 4	3.588	2.977	0.611	0.340	0.560	0.027	0.280		20,090	Fine granular, dark gray	7.1675
5441	No. 4½	3.354	2.530	0.824	0.462	1.360	0.037	0.338		35,980	Fine granular, gray	
5449	Salisbury pig, No. 3									21,500	Fine granular, variable, gray	7.1496
5450	Salisbury pig, No. 4									28,690	Fine granular, dark gray	7.1855
5451	....do	3.496	2.673	0.823	0.501	0.750	0.036	0.168		33,020	....do	7.2413
5422	Salisbury pig, No. 4, high									33,490	Fine granular, light gray	7.2575
5437	....do									34,300	....do	7.2655
5447	Salisbury pig, No. 4½									22,250	....do	7.2375
5425	Hamilton pig, No. 1 Foundry	3.790	3.705	0.085	0.664	2.910	0.025	0.607		10,120	Coarse granular, bright facets	6.8619
5426	Hamilton pig, No. 2 Foundry	3.795	3.790	0.005	0.675	2.547	0.040	0.622		12,310	Coarse and fine granular, bright facets	6.8877
5427	Hamilton pig, No. 1 Silvery	3.081	2.958	0.123	0.658	4.830	0.022	0.630		12,100	....do	6.8867
5428	Hamilton pig, No. 2 Silvery	3.274	3.193	0.081	0.684	3.760	0.020	0.622		10,390	....do	6.8662
5432	Landon pig									23,020	Fine granular, dark gray	7.1526
5458	Branded "Landon 1825"	3.324	2.435	0.889	0.450	1.000	0.139	0.383		35,420	....do	
5459	....do	3.064	2.344	0.720	0.400	0.950	0.143	0.326		24,100	Fine granular, gray	
	Spring Lake, Lake Superior charcoal pig:											
5434	No. 4	3.708	2.986	0.722		0.564	0.030	0.180		14,170	Granular, varying from coarse to fine	7.0893
5435	No. 4, high	3.490	2.181	1.319		0.488	0.041	0.164		18,510	....do	7.1463
5460	Warwick pig	3.714	3.326	0.388	0.285	3.008		0.583		10,370	Coarse and fine granular, brilliant facets	
5461	....do									10,620	....do	
5465	Tonawanda pig									13,610	Coarse and fine granular, bright facets	
5468	De Bardeleben pig									8,730	....do	
	Rockwood pig, No. 1, soft					2.400						

CAST IRON FROM PETERSBURG IRON WORKS COMPANY FOR STANDARDIZING THE TESTING MACHINE AT THE RICHMOND LOCOMOTIVE WORKS, RICHMOND, VA.

GROOVED FORM OF SPECIMENS.

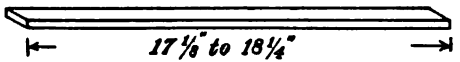
Test number.	Numbers.	Diameter.	Sectional area.	Tensile strength.		Appearance of fracture.
				Total.	Per square inch.	
		Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	
5394	A. S T. O. W	1.129	1.00	27,280	27,280	Fine granular, gray.
5395	A. C B. O. W	1.120	.985	23,510	23,870	Do.
5396	A. C T. I. W	1.110	.968	23,970	24,760	Do.
5397	A. S B. I. W	1.110	.968	25,390	26,230	Do.
5398	A. 2 S T. I. W	1.129	1.00	27,560	27,560	Do.
5399	A. 2 S T. O. R	1.129	1.00	26,390	26,390	Do.

STEEL PLATE

FOR

WATERTOWN ARSENAL BOILERS.

TENSILE TEST OF STEEL PLATE REPRESENTING MATERIAL USED IN ARSENAL SMITH SHOP BOILER.

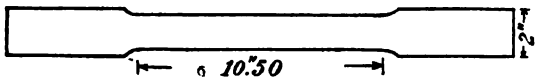


Specimens heated and straightened.

No. of test.	Dimensions in inches.		Sectional area.	Elastic limit.		Ultimate strength.		Elongation in 8 inches.		Area at fracture.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
	Width.	Thickness.		Total.	Per square inch.	Total.	Per square inch.	Inches.	Per cent.				
			Sq. in.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*			*In. In. Sq. in.*	*Per ct.*		" " " " " " " "
8769	1.507	.390	.588	25,600	43,540	34,320	58,370	1.64	20.5	1.13×.22=.249	57.7	Silky	.18, .13, .17, .17, .23, .33, .27, .16
8770	1.511	.392	.592	24,300	41,050	33,990	57,420	1.93	24.1	1.09×.23=.251	57.6	do	.65,* .28, .22, .22, .20, .14, .13, .09
8771	1.510	.389	.587	20,600	35,090	32,990	56,200	1.74	21.7	1.11×.25=.277	52.8	do	.11, .16, .19, .21, .64,* .20, .13, .10

TENSILE TESTS OF STEEL PLATE FROM SHEETS USED IN WATERTOWN ARSENAL BOILERS.

Sheets branded "Central Iron and Steel Works, Harrisburg, Pa. Fire Box Steel T. S. 60,000."



LONGITUDINAL SPECIMENS FROM FRONT SHEETS OF BOILERS.

No. of test.	Dimensions in inches.		Sectional area.	Elastic limit.		Ultimate strength.		Elongation in 8 inches.		Area at fracture.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
	Width.	Thickness.		Total.	Per square inch.	Total.	Per square inch.	Inches.	Per cent.				
			Sq. in.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*			*In. In. Sq. in.*	*Per ct.*		
8726	1.503	.458	.688	25,280	36,740	42,260	61,420	1.88	23.5	1.11 × .30 = .333	51.5	Silky.....	".60*,".29,".18,".17,".15,".15, ".16,".18.
8727	1.504	.464	.698	24,850	35,600	41,940	60,090	1.99	24.9	1.10 × .30 = .330	52.7	.....do.....	".25,".67*,".24,".21,".17,".15,".15,".15.
8728	1.504	.450	.677	23,100	34,120	40,300	59,530	2.08	26	1.11 × .28 = .311	54.1	.....do.....	".22,".65*,".29,".22,".21,".20,".16,".13.

LONGITUDINAL SPECIMENS FROM MIDDLE SHEETS OF BOILERS, TAKEN FROM METAL REMOVED TO FORM MANHOLES.

8729	1.503	.456	.685	25,450	37,150	43,960	64,170	2.11	26.4	1.13 × .30 = .339	50.5	Silky.....	".17,".19,".19,".20,".23,".48*,".45,".20.
8730	1.503	.453	.681	21,850	32,080	39,290	57,690	2.46	30.8	1.09 × .28 = .305	55.2	.....do.....	".21,".23,".31,".71*,".33,".26,".22,".19.
8731	1.502	.447	.671	22,900	34,130	40,720	60,690	2.53	31.6	1.12 × .30 = .336	49.9	.....do.....	".21,".24,".26,".30,".35,".65*,".28,".24.

CHAIN CABLE.

TENSION TESTS OF CHAIN CABLE FOR UNITED STATES LIGHT-HOUSE BOARD.

The electrically welded samples had the welding burrs on the links.

No. of test.	Metal.	Marks.	Kind of weld.	Number of links in sample.	Diameters.		Sectional area of chain.	Tensile strength.		Elongation at time of maximum load.	Fractured.
					End links.	Links of chain.		Total.	Per sq. inch.		
					Inches.	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Inches.*	
9180	Steel.....	No. 1.....	Electric	18	.....	.76	.907	25, 850	28, 500	3. 85 ±	Third link across welding burr. Silky, small granular spot.
9181	Iron	No. 5.....	.....do	19	.....	.76	.907	33, 720	37, 170	6. 17 ±	First link across welding burr. Dull spongy, discolored.
9182	Steel.....	No. 3.....	Hand	30	.....	.76	.907	38, 100	42, 010	13. 00 ±	First link, opposite quarter from weld. Silky.
9183	Iron	No. 7.....	.....do	39	.....	.76	.907	34, 680	38, 240	16. 42	Twelfth link. Followed the scarf in part, in part fibrous.
9184	Steel.....	No. 2.....	Electric	22	.....	.63	.623	21, 650	34, 750	6. 65	Fifth link across welding burr. Fine and coarse granular.
9185	Iron	No. 6.....	.....do	24	.....	.63	.623	10, 100	16, 210	.80	Eleventh link across welding burr. Spongy, discolored.
9186	Steel.....	No. 4.....	Hand	39	.....	.63	.623	23, 510	37, 740	12. 42	First link. Followed scarf weld.
9187	Iron	No. 8.....	.....do	45	.....	.64	.643	25, 200	39, 190	17. 10	Fourteenth link. Followed scarf weld.
9209	.....do	"Leb. Pa., L. C. W."	Hand	3	2. 03	1. 64	4. 22	172, 350	40, 840	.....	Middle link in the quarter weld. Fibrous 60 per cent, granular 40 per cent.
9210	.....do	.....do	.....do	3	2. 03	1. 65	4. 28	175, 980	41, 120	.....	Middle link in the quarter opposite welded end. Fibrous.

The measured elongations include the stretch of the chain and also the end links.

ELONGATION OF ELECTRICALLY WELDED STEEL CHAIN No. 1.

No. 9180.

Applied loads.		Elongation.	Set.	Remarks.
Total.	Per square inch.			
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
1,000	.....	0.	0.	Initial load.
2,000	.....	.02	.....	
3,000	.....	.04	.....	
4,000	.....	.07	.....	
5,000	.....	.12	.....	
6,000	.....	.16	.....	
7,000	.....	.20	.....	
8,000	.....	.28	.....	
9,000	.....	.27	.....	
10,000	.....	.32	.....	
11,000	.....	.37	.....	
12,000	.....	.45	.....	
13,000	.....	.53	.....	
14,000	.....	.70	.....	
15,000	.....	.90	.....	
16,000	.....	1.10	.....	
17,000	.....	1.33	.....	
18,000	.....	1.58	.....	
19,000	.....	1.86	.....	
20,000	.....	2.14	.....	
21,000	.....	2.46	.....	
22,000	.....	2.77	.....	
23,000	.....	3.10	.....	
24,000	.....	3.44	.....	
25,000	.....	3.85	.....	
25,850	28,500	.....	.....	Tensile strength.

Fractured third link across welding burr. Silky, small granular spot.

ELONGATION OF ELECTRICALLY WELDED IRON CHAIN No. 5.

No. 9181.

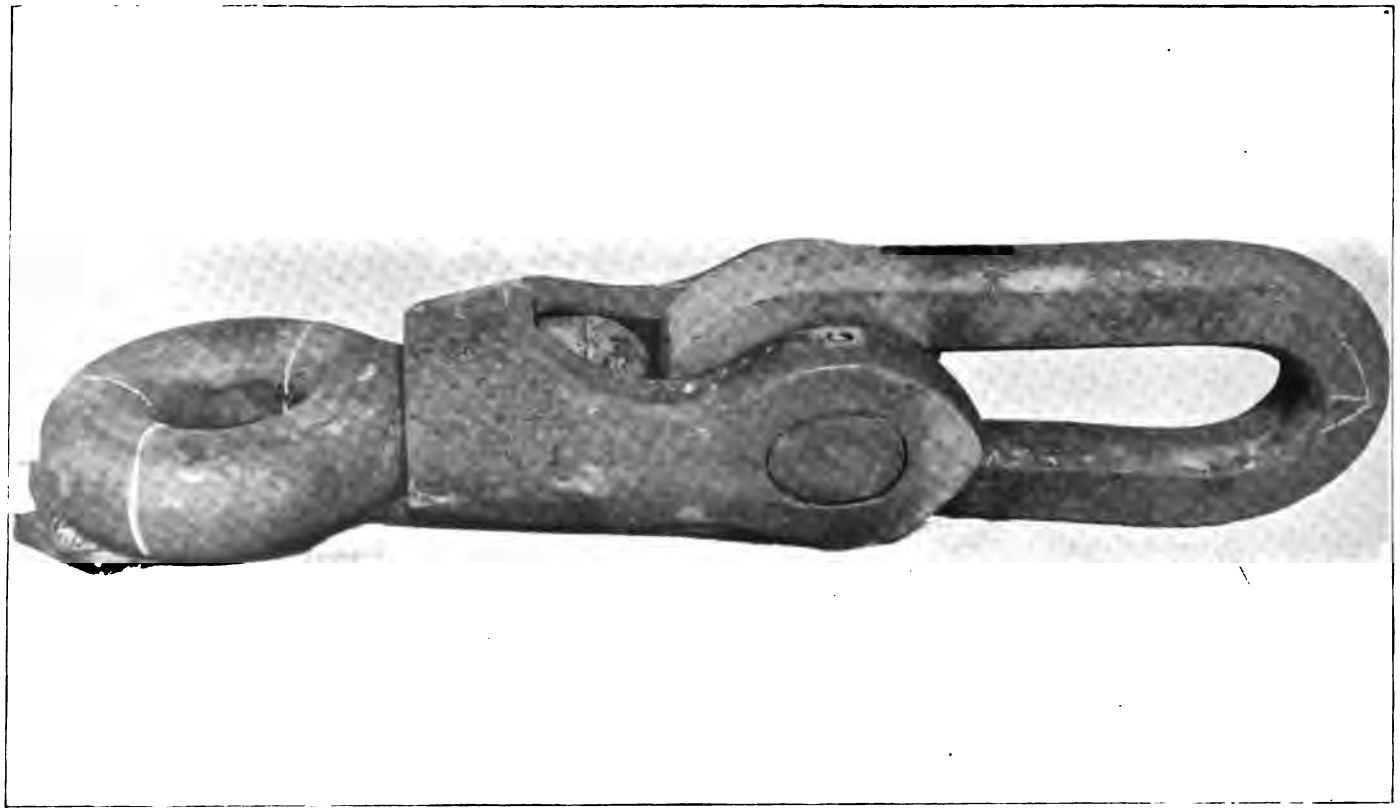
Applied loads.		Elongation.	Set.	Remarks.
Total.	Per square inch.			
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
1,000	.....	0.	0.	Initial load.
2,000	.....	.02	.....	
3,000	.....	.05	.....	
4,000	.....	.09	.....	
5,000	.....	.12	.....	
6,000	.....	.15	.....	
7,000	.....	.18	.....	
8,000	.....	.20	.....	
9,000	.....	.22	.....	
10,000	.....	.26	.....	
11,000	.....	.29	.....	
12,000	.....	.33	.....	
13,000	.....	.38	.....	
14,000	.....	.47	.....	
15,000	.....	.59	.....	
16,000	.....	.74	.....	
17,000	.....	.93	.....	
18,000	.....	1.20	.....	
19,000	.....	1.46	.....	
20,000	.....	1.75	.....	
21,000	.....	2.07	.....	
22,000	.....	2.40	.....	
23,000	.....	2.75	.....	
24,000	.....	3.11	.....	
25,000	.....	3.48	.....	
26,000	.....	3.91	.....	
27,000	.....	4.25	.....	
28,000	.....	4.73	.....	
29,000	.....	5.18	.....	
30,000	.....	5.65	.....	
31,000	.....	6.10	.....	
31,480	.....	.....	.....	End link fractured. New end link put in and test resumed 2½ hours later.
33,720	37,170	6.17	.....	Tensile strength.

Fractured first link across welding burr. Dull, spongy, discolored.

CHAIN IRON

AND

FRACTURED LINK OF CHAIN ANNEALED.

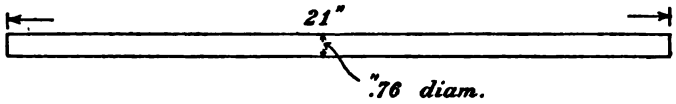


SWIVEL-SHACKLE, SHOWING LOCATION OF FRACTURES IN.

FRACTURED ENDS OF SWIVEL-SHACKLE.

TENSION TEST OF BAR OF BURDEN'S BEST WROUGHT IRON FOR SLING CHAINS.

No. 8924.

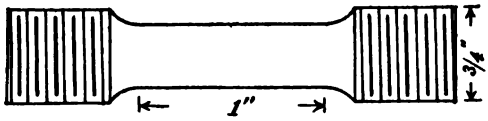


Sectional area, .454 square inch.
Elastic limit, 13,510 pounds = 29,760 pounds per square inch.
Tensile strength, 21,720 pounds = 47,840 pounds per square inch.
Elongation in 10 inches, 2.″63 = 26.3 per cent.
Elongation of inch sections, ″.58*, ″.35, ″.25, ″.23, ″.23, ″.19, ″.21.
Diameter at fracture, ″.51; area, .204 square inch.
Contraction of area, 55.1 per cent.
Appearance of fracture, fibrous.

TENSILE TEST OF SAMPLE OF WROUGHT IRON TAKEN FROM A FRACTURED LINK OF CHAIN.

Sample annealed before testing.
The fractures in the link were granular.
This link had been in use for a long time, and showed marks of having been hammered and deeply indented thereby.

No. 8746.



Diameter, ″.505.
Sectional area, .20 square inch.
Elastic limit, 5,210 pounds = 26,050 pounds per square inch.
Tensile strength, 8,320 pounds = 41,600 pounds per square inch.
Elongation in 1 inch, ″.65 = 65 per cent.
Diameter at fracture, ″.26; area, .053 square inch.
Contraction of area, 73.5 per cent.
Appearance of fracture, fine fibrous.

TENSILE TEST OF A KEENAN SWIVEL-SHACKLE FOR 2½-INCH CABLE FOR THE BUREAU OF EQUIPMENT, BOSTON NAVY-YARD.

No. 8719.

Weight, 219 pounds.
Tensile strength, 445,400 pounds.
Fractured eye of swivel across the front and in two quarters, detaching two pieces from the eye.
The fracture across the front of the eye was granular 45 per cent, fibrous lamellar 55 per cent. The fractures in the quarters were granular throughout, varying in the size of the grains.
Diameter of iron in the eye, 3⅝″.

BRONZE AND COPPER.

BRONZE FROM WATERTOWN ARSENAL FOUNDRY.

Composition..... { Cu.....per cent.. 57.5
Zn .....do..... 42.
Sn .....do..... .5

Specimens taken from coupons about $1\frac{1}{4}$" by $1\frac{1}{8}$", cast with and attached to the dry-sand castings which they represent.

Description.	Diameter.	Sectional area.	Tensile strength per square inch.	Gauged length.	Elongation in gauged length	Contraction of area.	Fracture.
	Inch.	*Sq. in.*	*Pounds.*	*Inches.*	*Per ct.*	*Per ct.*	
8" loading tray	0.564	0.25	55,280	2	33	33.6	Light yellow.
Do.....	.564	.25	53,640	2	18	27.6	Uniform light yellow.
Do.....	.594	.25	51,800	2	19	21.6	Light lavender; yellow spot at circumference.
10" breech plate No. 1.	.564	.25	56,840	2	33.5	36.4	Light yellow.
10" breech plate No. 2.	.564	.25	57,160	2	30	39.2	Do.
10" breech plate No. 3.	.564	.25	54,560	2	30	33.6	Do.
10" breech plate No. 4.	.564	.25	54,240	2	28	36.4	Do.
10" breech plate No. 5.	.564	.25	54,080	2	29	33.6	Do.
10" breech plate No. 6.	.564	.25	55,920	2	29.5	30.4	Do.
10" breech plate No. 7.	.564	.25	54,080	2	27.5	30.4	Do.
10" breech plate No. 8.	.564	.25	54,720	2	27	33.6	Light yellow; oblique.
10" breech plate No. 9.	.564	.25	55,920	2	32	33.6	Do.
12" breech plate No. 1.	.564	.25	54,840	2	32.5	36.4	Do.
12" breech plate No. 2.	.564	.25	55,120	2	32.5	33.6	Uniform light yellow.
12" breech plate No. 3.	.564	.25	56,720	2	37	42	Do.
12" breech plate No. 4.	.564	.25	59,220	2	17.5	21.6	Light yellow; spongy at circumference.
12" breech plate No. 5.	.564	.25	54,160	2	27.5	30.4	Uniform light yellow.
12" breech plate No. 6.	.564	.25	56,489	2	35.5	33.6	Do.
12" breech plate No. 7.	.564	.25	53,240	2	24.5	27.6	Light yellow; spongy spot at circumference.
12" breech plate No. 8.	.564	.25	53,720	2	21	21.6	Do.
12" breech plate No. 9.	.564	.25	55,760	2	29	36.4	Uniform light yellow.
12" breech plate No. 10.	.564	.25	54,920	2	26	27.6	Light yellow; oblique.
12" breech plate No. 11.	.564	.25	54,040	2	23	27.6	Light yellow, with dark yellow spots.
12" loading tray No. 12.	.564	.25	50,760	2	17.5	27.6	Light yellow, with yellow metal interspersed.
12" loading tray No. 13.	.564	.25	55,960	2	35	39.2	Light yellow; oblique.
10" breech plate No. 1.	.564	.25	54,880	2	34.5	27.6	Uniform light yellow; oblique.
10" breech plate No. 2.	.564	.25	58,600	2	36	33.6	Do.
10" breech plate No. 3.	.564	.25	55,920	2	32.5	30.4	Do.
10" breech plate No. 4.	.564	.25	56,320	2	34	36.4	Uniform light yellow.
10" breech plate No. 5.	.564	.25	54,880	2	26.5	30.4	Do.

SPECIAL TESTS.

Composition.				Diameter.	Sectional area.	Tensile strength per square inch.	Gauged length.	Elongation in gauged length.	Contraction of area.	Fracture.
Cu.	Sn.	Zn. Old.	Zn. Best quality.							
Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Inch.*	*Sq. in.*	*Pounds.*	*Inches.*	*Per ct.*	*Per ct.*	
88	10	2	.....	.564	.25	25,280	2	12.5	15.2	Golden yellow.
88	10	2	.....	.564	.25	31,520	2	19.5	21.6	Do.
88	10	.....	2	.564	.25	34,640	2	20.5	21.6	Golden yellow; fine silky.
88	10	.....	2	.564	.25	31,360	2	17	21.6	Golden yellow; spongy center.

TENSILE TEST OF CAST COPPER.

BARS FROM MAGUIRE & BAUCUS, LIMITED.

No. of test.	Mark on specimen.	Diameter.	Sectional area.	Ultimate strength.		Elongation in 4 and 10 inches.		Area at fracture.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
				Total.	Per square inch.	Inches.	Per cent.				
		Inches.	*Sq. in.*	*Pounds.*	*Pounds.*			*In. Sq. in.*	*Per ct.*		
8814	.....	.755	.448	12,920	28,840	1.59	39.8	Diam. .58=.264	41.1	Uniform granular ..	".51*, ".42, ".35, ".31.
8815	.....	1.004	.792	14,830	18,720	1.46	14.6	Diam. .90=.636	19.7	Uniform vesicular surface.	".12, ".14, ".13, ".14, ".16, ".14, ".13, ".21*, ".15, ".14.

BARS FROM WATERTOWN ARSENAL FOUNDRY.

						Elongation in 5 and 4 inches.					
8816	Cast in chill	1.006	.795	17,520	22,040	.91	18.2	Diam. .85=.567	28.7	Uniform color, vesicular surface.	".29*, ".17, ".15, ".15, ".15.
8817	Cast in sand	.756	.449	10,490	23,360	1.09	27.2	Diam. .64=.322	28.3	Irregular spongy surface.	.26, .39*, .23, .21.

COPPER CYLINDERS FOR PRESSURE GAUGES.

COPPER CYLINDERS FOR PRESSURE GAUGES.

Mean compression of 10 copper cylinders for small-arms pressure gauge, from copper purchased at Frankford Arsenal in October, 1895. Mean dimensions of coppers: Length, ".4992; diameter, ".2055.

Load per square inch on crusher gauge $\frac{1}{10}$ square inch area.	Total compressions.											Mean corrected sets.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
3,000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
6,000	.0004	.0004	.0004	.0002	.0002	.0003	.0002	.0003	.0002	.0003	.0003	.0003
9,000	.0010	.0008	.0008	.0005	.0003	.0007	.0006	.0007	.0005	.0007	.0007	.0006
9,500	.0010	.0009	.0009	.0007	.0005	.0007	.0008	.0008	.0006	.0007	.0008	.0007
10,000	.0010	.0010	.0011	.0010	.0007	.0008	.0009	.0009	.0006	.0008	.0009	.0008
10,500	.0012	.0012	.0012	.0015	.0010	.0010	.0010	.0010	.0007	.0009	.0011	.0010
11,000	.0014	.0015	.0015	.0020	.0015	.0014	.0012	.0014	.0008	.0011	.0014	.0013
11,500	.0017	.0020	.0020	.0025	.0020	.0017	.0020	.0019	.0010	.0016	.0018	.0017
12,000	.0022	.0027	.0025	.0031	.0026	.0023	.0025	.0025	.0017	.0023	.0024	.0023
12,500	.0027	.0030	.0032	.0040	.0032	.0029	.0032	.0031	.0025	.0029	.0031	.0030
13,000	.0034	.0037	.0038	.0044	.0041	.0035	.0037	.0036	.0030	.0035	.0037	.0036
13,500	.0042	.0041	.0043	.0053	.0043	.0040	.0043	.0045	.0035	.0040	.0043	.0042
14,000	.0050	.0050	.0053	.0058	.0050	.0048	.0051	.0051	.0045	.0049	.0050	.0048
14,500	.0056	.0058	.0055	.0066	.0061	.0056	.0058	.0059	.0050	.0055	.0057	.0055
15,000	.0062	.0066	.0067	.0077	.0071	.0062	.0066	.0069	.0059	.0064	.0066	.0064
15,500	.0070	.0076	.0074	.0084	.0076	.0073	.0074	.0076	.0066	.0070	.0074	.0072
16,000	.0075	.0081	.0079	.0090	.0084	.0078	.0081	.0084	.0074	.0079	.0081	.0078
16,500	.0085	.0090	.0090	.0102	.0094	.0089	.0091	.0091	.0084	.0089	.0090	.0086
17,000	.0095	.0096	.0098	.0113	.0107	.0095	.0100	.0100	.0090	.0098	.0099	.0095
17,500	.0101	.0106	.0112	.0120	.0113	.0104	.0110	.0112	.0100	.0107	.0109	.0105
18,000	.0115	.0118	.0118	.0130	.0124	.0116	.0121	.0121	.0111	.0115	.0119	.0115
18,500	.0121	.0128	.0126	.0140	.0135	.0125	.0128	.0131	.0118	.0125	.0128	.0124
19,000	.0135	.0138	.0135	.0152	.0140	.0134	.0139	.0142	.0126	.0135	.0138	.0134
19,500	.0141	.0143	.0149	.0160	.0152	.0145	.0148	.0149	.0138	.0144	.0147	.0143
20,000	.0152	.0154	.0155	.0173	.0165	.0154	.0158	.0162	.0147	.0154	.0157	.0152
20,500	.0160	.0167	.0163	.0177	.0171	.0165	.0170	.0170	.0155	.0165	.0166	.0161
21,000	.0169	.0178	.0171	.0186	.0183	.0180	.0180	.0184	.0166	.0174	.0177	.0172
21,500	.0178	.0188	.0185	.0198	.0195	.0184	.0188	.0189	.0177	.0185	.0187	.0182
22,000	.0189	.0194	.0193	.0209	.0208	.0192	.0202	.0198	.0185	.0195	.0196	.0191
22,500	.0199	.0209	.0209	.0217	.0211	.0203	.0208	.0207	.0193	.0205	.0206	.0201
23,000	.0210	.0219	.0218	.0226	.0222	.0215	.0219	.0220	.0205	.0214	.0217	.0211
23,500	.0219	.0229	.0225	.0242	.0234	.0223	.0228	.0226	.0217	.0228	.0227	.0221
24,000	.0230	.0240	.0234	.0249	.0249	.0229	.0246	.0239	.0230	.0235	.0238	.0232
24,500	.0240	.0255	.0249	.0260	.0254	.0241	.0254	.0252	.0240	.0246	.0249	.0243
25,000	.0252	.0261	.0255	.0268	.0265	.0254	.0268	.0262	.0248	.0255	.0259	.0252
25,500	.0262	.0267	.0264	.0282	.0273	.0263	.0273	.0273	.0263	.0269	.0269	.0262
26,000	.0270	.0282	.0277	.0293	.0282	.0276	.0280	.0281	.0274	.0277	.0279	.0272
26,500	.0281	.0291	.0288	.0304	.0289	.0285	.0294	.0290	.0279	.0287	.0289	.0282
27,000	.0294	.0304	.0305	.0318	.0305	.0298	.0308	.0308	.0295	.0303	.0304	.0296
27,500	.0305	.0315	.0309	.0328	.0318	.0308	.0318	.0315	.0300	.0310	.0313	.0305
28,000	.0319	.0330	.0317	.0337	.0324	.0320	.0324	.0325	.0319	.0319	.0323	.0315
28,500	.0327	.0333	.0327	.0347	.0335	.0331	.0333	.0337	.0334	.0330	.0333	.0325
29,000	.0338	.0352	.0338	.0359	.0347	.0346	.0345	.0347	.0340	.0342	.0335	.0336
29,500	.0349	.0357	.0348	.0368	.0354	.0352	.0355	.0355	.0354	.0352	.0354	.0345
30,000	.0362	.0366	.0357	.0380	.0365	.0374	.0365	.0363	.0368	.0363	.0366	.0356
30,500	.0378	.0380	.0367	.0390	.0381	.0378	.0380	.0370	.0375	.0375	.0377	.0367
31,000	.0382	.0390	.0380	.0401	.0392	.0382	.0391	.0384	.0390	.0388	.0388	.0378
31,500	.0390	.0400	.0389	.0413	.0400	.0389	.0404	.0395	.0402	.0400	.0398	.0388
32,000	.0400	.0410	.0397	.0423	.0413	.0400	.0415	.0402	.0413	.0409	.0408	.0398
32,500	.0417	.0423	.0408	.0440	.0426	.0416	.0427	.0420	.0419	.0421	.0422	.0412
33,000	.0424	.0445	.0420	.0448	.0438	.0429	.0438	.0430	.0433	.0435	.0434	.0424
33,500	.0437	.0452	.0431	.0459	.0445	.0440	.0454	.0441	.0444	.0445	.0444	.0434
34,000	.0444	.0459	.0441	.0471	.0458	.0450	.0460	.0455	.0453	.0455	.0455	.0444
34,500	.0455	.0467	.0452	.0483	.0471	.0463	.0472	.0465	.0466	.0465	.0466	.0455
35,000	.0469	.0488	.0467	.0492	.0480	.0475	.0484	.0478	.0471	.0480	.0478	.0467
35,500	.0479	.0493	.0476	.0500	.0489	.0487	.0498	.0485	.0492	.0488	.0489	.0478
36,000	.0489	.0504	.0487	.0514	.0505	.0494	.0512	.0493	.0511	.0502	.0501	.0490
36,500	.0502	.0515	.0503	.0525	.0511	.0507	.0522	.0506	.0522	.0511	.0512	.0501
37,000	.0518	.0524	.0513	.0540	.0532	.0522	.0540	.0518	.0526	.0521	.0525	.0514
37,500	.0527	.0538	.0520	.0547	.0540	.0532	.0545	.0527	.0545	.0531	.0535	.0524
38,000	.0538	.0548	.0530	.0559	.0550	.0540	.0558	.0536	.0550	.0548	.0546	.0535
38,500	.0547	.0561	.0540	.0575	.0555	.0552	.0564	.0549	.0556	.0559	.0556	.0545
39,000	.0558	.0574	.0552	.0587	.0569	.0560	.0580	.0568	.0570	.0573	.0569	.0558

Copper cylinders for pressure gauges—Continued.

Load per square inch on crusher gauge $\frac{1}{10}$ square inch area.	Total compressions.											Mean corrected sets.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
39,500	.0570	.0587	.0565	.0595	.0581	.0575	.0591	.0579	.0580	.0580	.0580	.0569
40,000	.0582	.0591	.0574	.0606	.0593	.0584	.0605	.0586	.0595	.0590	.0591	.0580
40,500	.0593	.0596	.0585	.0618	.0604	.0598	.0618	.0595	.0604	.0604	.0601	.0590
41,000	.0606	.0610	.0597	.0637	.0619	.0610	.0625	.0603	.0610	.0615	.0618	.0602
41,500	.0616	.0625	.0610	.0643	.0630	.0623	.0638	.0621	.0618	.0629	.0625	.0614
42,000	.0622	.0634	.0624	.0655	.0642	.0631	.0655	.0636	.0630	.0638	.0637	.0626
42,500	.0630	.0650	.0636	.0666	.0650	.0646	.0666	.0644	.0648	.0649	.0648	.0637
43,000	.0643	.0658	.0647	.0675	.0670	.0656	.0676	.0651	.0663	.0661	.0660	.0649
43,500	.0656	.0668	.0658	.0689	.0675	.0670	.0690	.0661	.0675	.0683	.0672	.0661
44,000	.0669	.0683	.0670	.0701	.0683	.0684	.0695	.0676	.0681	.0689	.0683	.0672
44,500	.0683	.0693	.0680	.0708	.0705	.0693	.0705	.0689	.0693	.0696	.0695	.0684
45,000	.0695	.0707	.0691	.0724	.0715	.0710	.0720	.0709	.0706	.0712	.0709	.0698
45,500	.0705	.0720	.0703	.0737	.0724	.0715	.0730	.0716	.0725	.0729	.0720	.0709
46,000	.0720	.0726	.0721	.0744	.0731	.0729	.0738	.0727	.0734	.0740	.0731	.0720
46,500	.0730	.0734	.0734	.0756	.0745	.0738	.0758	.0739	.0738	.0745	.0742	.0731
47,000	.0740	.0750	.0742	.0766	.0762	.0747	.0770	.0750	.0751	.0756	.0753	.0741
47,500	.0753	.0766	.0751	.0777	.0772	.0758	.0779	.0765	.0764	.0764	.0765	.0753
48,000	.0766	.0777	.0766	.0796	.0790	.0770	.0787	.0778	.0771	.0772	.0777	.0765
48,500	.0776	.0784	.0777	.0808	.0798	.0780	.0810	.0793	.0779	.0785	.0789	.0777
49,000	.0788	.0800	.0790	.0817	.0810	.0795	.0825	.0800	.0793	.0798	.0802	.0790
49,500	.0802	.0813	.0800	.0826	.0816	.0805	.0834	.0810	.0810	.0811	.0813	.0801
50,000	.0814	.0825	.0812	.0848	.0839	.0813	.0840	.0821	.0825	.0824	.0826	.0814
50,500	.0826	.0840	.0829	.0860	.0850	.0821	.0855	.0835	.0841	.0836	.0839	.0827
51,000	.0837	.0849	.0839	.0871	.0861	.0832	.0870	.0846	.0850	.0849	.0850	.0838
51,500	.0851	.0862	.0850	.0880	.0868	.0855	.0880	.0856	.0864	.0860	.0863	.0851
52,000	.0865	.0874	.0862	.0888	.0877	.0870	.0887	.0870	.0874	.0870	.0874	.0862
52,500	.0877	.0885	.0875	.0898	.0890	.0876	.0896	.0880	.0882	.0880	.0884	.0872
53,000	.0888	.0895	.0884	.0912	.0903	.0886	.0910	.0895	.0885	.0891	.0895	.0883
53,500	.0904	.0912	.0895	.0925	.0914	.0896	.0925	.0908	.0899	.0906	.0908	.0896
54,000	.0920	.0920	.0910	.0936	.0933	.0914	.0935	.0920	.0915	.0919	.0922	.0910
54,500	.0930	.0932	.0921	.0944	.0939	.0930	.0944	.0932	.0929	.0930	.0933	.0921
55,000	.0943	.0943	.0936	.0952	.0949	.0938	.0955	.0945	.0935	.0938	.0943	.0931
55,000	.0951	.0951	.0950	.0964	.0961	.0949	.0968	.0956	.0942	.0950	.0954	.0942
50,000	.0965	.0964	.0962	.0981	.0981	.0965	.0975	.0970	.0954	.0962	.0968	.0956
56,500	.0976	.0975	.0975	.0997	.0995	.0973	.0989	.0985	.0974	.0973	.0981	.0969
57,000	.0987	.0990	.0987	.1005	.1002	.0984	.1015	.1001	.0990	.0995	.0996	.0984
57,500	.1007	.1003	.0997	.1015	.1012	.0998	.1025	.1012	.1000	.1010	.1008	.0996
58,000	.1017	.1014	.1008	.1026	.1026	.1011	.1031	.1024	.1010	.1018	.1018	.1006
58,500	.1026	.1025	.1029	.1035	.1035	.1020	.1037	.1034	.1015	.1026	.1028	.1016
59,000	.1040	.1037	.1037	.1046	.1047	.1035	.1042	.1044	.1029	.1038	.1039	.1026
59,500	.1053	.1050	.1053	.1062	.1070	.1048	.1051	.1057	.1045	.1054	.1054	.1041
60,000	.1073	.1068	.1065	.1071	.1094	.1062	.1070	.1070	.1059	.1070	.1070	.1057
60,500	.1080	.1081	.1077	.1082	.1098	.1072	.1086	.1085	.1069	.1078	.1081	.1068
61,000	.1088	.1087	.1085	.1093	.1105	.1086	.1097	.1094	.1075	.1088	.1090	.1077
61,500	.1101	.1096	.1095	.1111	.1110	.1100	.1113	.1108	.1089	.1098	.1102	.1089
62,000	.1116	.1110	.1111	.1125	.1128	.1109	.1129	.1120	.1105	.1113	.1117	.1104
62,500	.1126	.1125	.1125	.1135	.1141	.1121	.1135	.1134	.1120	.1126	.1129	.1116
63,000	.1141	.1137	.1139	.1144	.1149	.1138	.1144	.1144	.1130	.1140	.1141	.1128
63,500	.1152	.1145	.1148	.1157	.1160	.1146	.1162	.1163	.1138	.1151	.1152	.1139
64,000	.1162	.1156	.1158	.1174	.1170	.1158	.1176	.1174	.1149	.1160	.1164	.1151
64,500	.1177	.1168	.1168	.1184	.1183	.1170	.1185	.1181	.1159	.1170	.1174	.1161
65,000	.1188	.1179	.1180	.1197	.1195	.1183	.1200	.1195	.1171	.1185	.1187	.1174
65,500	.1206	.1192	.1197	.1210	.1210	.1195	.1215	.1208	.1185	.1200	.1202	.1189
66,000	.1217	.1208	.1209	.1222	.1222	.1212	.1224	.1223	.1205	.1219	.1217	.1204
66,500	.1226	.1220	.1217	.1230	.1236	.1220	.1237	.1234	.1216	.1225	.1226	.1213
67,000	.1240	.1228	.1230	.1244	.1249	.1232	.1250	.1243	.1229	.1230	.1237	.1224
67,500	.1252	.1243	.1250	.1256	.1259	.1246	.1265	.1254	.1240	.1239	.1250	.1237
68,000	.1267	.1257	.1261	.1270	.1269	.1259	.1270	.1277	.1246	.1259	.1263	.1249
68,500	.1281	.1269	.1271	.1280	.1286	.1271	.1282	.1285	.1260	.1271	.1276	.1262
69,000	.1295	.1281	.1285	.1295	.1306	.1281	.1295	.1293	.1273	.1284	.1289	.1275
69,500	.1306	.1295	.1300	.1309	.1313	.1295	.1313	.1304	.1291	.1296	.1302	.1288
70,000	.1317	.1306	.1316	.1322	.1318	.1308	.1327	.1320	.1300	.1312	.1315	.1301
70,500	.1327	.1320	.1326	.1330	.1340	.1322	.1334	.1334	.1311	.1322	.1327	.1313
71,000	.1339	.1333	.1341	.1343	.1351	.1335	.1350	.1350	.1325	.1334	.1340	.1326
71,500	.1355	.1345	.1353	.1366	.1358	.1349	.1361	.1362	.1336	.1348	.1353	.1339
72,000	.1365	.1355	.1380	.1377	.1370	.1360	.1374	.1370	.1345	.1361	.1366	.1352
72,500	.1376	.1370	.1391	.1382	.1381	.1373	.1384	.1378	.1358	.1373	.1377	.1363
73,000	.1388	.1381	.1397	.1395	.1394	.1383	.1397	.1390	.1369	.1381	.1387	.1373
73,500	.1403	.1392	.1405	.1413	.1405	.1392	.1405	.1404	.1384	.1395	.1400	.1386
74,000	.1422	.1406	.1417	.1425	.1419	.1402	.1418	.1420	.1395	.1410	.1413	.1399
74,500	.1429	.1418	.1528	.1431	.1430	.1424	.1435	.1431	.1408	.1418	.1425	.1411

Copper cylinders for pressure gauges—Continued.

Load per square inch on crusher gauge $\frac{1}{10}$ square inch area.	Total compressions.											Mean corrected sets.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
75,000	.1440	.1428	.1443	.1442	.1448	.1436	.1452	.1445	.1420	.1434	.1439	.1425
75,500	.1465	.1436	.1454	.1458	.1460	.1449	.1457	.1454	.1430	.1445	.1451	.1437
76,000	.1471	.1449	.1466	.1472	.1470	.1458	.1466	.1463	.1441	.1455	.1461	.1447
76,500	.1476	.1463	.1480	.1483	.1477	.1468	.1474	.1475	.1455	.1464	.1471	.1457
77,000	.1491	.1474	.1490	.1493	.1484	.1478	.1486	.1489	.1470	.1476	.1483	.1469
77,500	.1501	.1485	.1504	.1503	.1496	.1490	.1498	.1505	.1475	.1488	.1494	.1480
78,000	.1514	.1495	.1514	.1521	.1524	.1510	.1512	.1520	.1490	.1500	.1510	.1496
78,500	.1524	.1508	.1520	.1528	.1532	.1519	.1523	.1531	.1505	.1512	.1520	.1506
79,000	.1533	.1518	.1535	.1538	.1546	.1525	.1539	.1540	.1515	.1524	.1531	.1517
79,500	.1547	.1527	.1541	.1550	.1554	.1539	.1543	.1547	.1526	.1535	.1541	.1527
80,000	.1556	.1537	.1548	.1565	.1564	.1555	.1552	.1558	.1536	.1546	.1552	.1538
80,500	.1567	.1547	.1563	.1576	.1574	.1563	.1570	.1573	.1544	.1557	.1563	.1549
81,000	.1583	.1560	.1574	.1589	.1585	.1583	.1580	.1585	.1560	.1570	.1577	.1563
81,500	.1595	.1578	.1586	.1598	.1597	.1595	.1591	.1598	.1585	.1580	.1590	.1576
82,000	.1605	.1584	.1597	.1615	.1611	.1603	.1600	.1608	.1589	.1590	.1600	.1586
82,500	.1617	.1590	.1608	.1628	.1619	.1609	.1611	.1624	.1596	.1604	.1611	.1597
83,000	.1635	.1604	.1620	.1635	.1625	.1620	.1622	.1633	.1602	.1615	.1621	.1607
83,500	.1645	.1624	.1635	.1643	.1638	.1628	.1631	.1645	.1610	.1625	.1632	.1618
84,000	.1652	.1634	.1650	.1653	.1646	.1638	.1651	.1656	.1626	.1634	.1644	.1630
84,500	.1665	.1644	.1662	.1665	.1657	.1655	.1660	.1666	.1634	.1645	.1655	.1641
85,000	.1673	.1649	.1670	.1680	.1669	.1670	.1667	.1675	.1648	.1658	.1666	.1652
85,500	.1684	.1660	.1677	.1690	.1686	.1680	.1677	.1691	.1655	.1670	.1677	.1663
86,000	.1696	.1679	.1687	.1696	.1697	.1690	.1689	.1700	.1665	.1679	.1688	.1674
86,500	.1710	.1688	.1699	.1711	.1708	.1702	.1706	.1708	.1677	.1689	.1700	.1686
87,000	.1715	.1705	.1710	.1730	.1725	.1710	.1721	.1720	.1691	.1703	.1713	.1699
87,500	.1724	.1712	.1721	.1739	.1733	.1721	.1724	.1728	.1704	.1715	.1722	.1708
88,000	.1740	.1718	.1735	.1745	.1738	.1730	.1734	.1738	.1716	.1725	.1732	.1718
88,500	.1747	.1725	.1743	.1752	.1744	.1739	.1740	.1749	.1722	.1730	.1739	.1725
89,000	.1763	.1735	.1755	.1769	.1751	.1749	.1749	.1757	.1730	.1740	.1750	.1736
89,500	.1770	.1744	.1764	.1790	.1760	.1760	.1758	.1775	.1741	.1752	.1761	.1747
90,000	.1783	.1765	.1778	.1807	.1778	.1768	.1770	.1795	.1754	.1775	.1777	.1763
90,500	.1793	.1773	.1786	.1811	.1787	.1780	.1778	.1802	.1772	.1782	.1786	.1772
91,000	.1803	.1779	.1795	.1816	.1797	.1790	.1788	.1810	.1780	.1785	.1794	.1780
91,500	.1814	.1784	.1803	.1820	.1807	.1801	.1796	.1819	.1788	.1794	.1803	.1789
92,000	.1823	.1794	.1815	.1824	.1820	.1818	.1809	.1830	.1798	.1805	.1814	.1800
92,500	.1835	.1810	.1826	.1833	.1827	.1829	.1824	.1844	.1807	.1820	.1825	.1811
93,000	.1845	.1828	.1837	.1841	.1944	.1839	.1834	.1852	.1820	.1829	.1837	.1823
93,500	.1860	.1833	.1846	.1864	.1854	.1846	.1840	.1858	.1830	.1835	.1847	.1833
94,000	.1867	.1840	.1855	.1874	.1861	.1855	.1846	.1866	.1838	.1845	.1855	.1841
94,500	.1873	.1846	.1869	.1879	.1868	.1864	.1860	.1883	.1850	.1860	.1865	.1851
95,000	.1884	.1864	.1878	.1885	.1881	.1873	.1868	.1892	.1865	.1866	.1876	.1862
95,500	.1893	.1871	.1888	.1897	.1890	.1880	.1877	.1900	.1875	.1873	.1884	.1870
96,000	.1907	.1880	.1897	.1913	.1900	.1891	.1891	.1911	.1885	.1888	.1896	.1892
96,500	.1917	.1890	.1906	.1925	.1914	.1902	.1899	.1921	.1895	.1899	.1907	.1893
97,000	.1923	.1900	.1919	.1934	.1923	.1914	.1906	.1932	.1905	.1907	.1916	.1902
97,500	.1941	.1909	.1930	.1942	.1927	.1925	.1919	.1941	.1918	.1917	.1927	.1913
98,000	.1949	.1922	.1940	.1952	.1940	.1936	.1928	.1956	.1934	.1926	.1938	.1924
98,500	.1952	.1928	.1947	.1964	.1947	.1954	.1942	.1964	.1938	.1934	.1947	.1933
99,000	.1962	.1940	.1955	.1975	.1955	.1960	.1953	.1970	.1948	.1945	.1956	.1942
99,500	.1969	.1947	.1966	.1981	.1960	.1965	.1958	.1975	.1953	.1957	.1963	.1949
100,000	.1977	.1955	.1977	.1988	.1968	.1969	.1965	.1985	.1964	.1965	.1971	.1957

STEEL MUSIC WIRE.

STEEL MUSIC WIRE.

Wire made by Felten & Guilleaume, Carlswerk, Mülheim, Germany. Submitted for testing by Hammacher, Schlemmer & Co., New York. Material received in original coils, weighing about 4 ounces each. Diameter of coils 4″.

No. of gauge.	Diameter of wire.	Diameter of coil, wire free.
	Inch.	*Inches.*
12	.0286	17
13	.0313	9 to 11
14	.0330	9 to 14
15	.0352	7 to 9
16	.0369	7 to 8
17	.0380	7 to 12
18	.0412	7
19	.0430	7.2 to 8.3
20	.0443	7.6 to 8.5
21	.0463	8.5 to 11.5
22	.0478	7.7 to 9
23	.0513	7.1

TENSION TESTS.

No. of test.	No. of gauge.	Diameter.	Sectional area.	Tensile strength. Total.	Tensile strength. Per square inch.	Area at fracture.	Contraction of area.	Fracture.
		Inch.	*Sq. inch.*	*Pounds.*	*Pounds.*	*Inch. Sq. inch.*	*Per cent.*	
9238	12	.0286	.000642	243	378,500	Diam. .022 = .000380	40.8	2″.50 from jaws, fine silky. Cup-shaped ends.
				238	370,720	Diam. .023 = .000415	35.4	2″.75 from jaws, fine silky. Cup-shaped ends.
				239	372,270	Diam. .023 = .000415	35.4	2″.85 from jaws, fine silky. Cup-shaped ends.
9261*	12	.0286	.000642	237	369,160	Diam. .023 = .000415	35.4	At face of jaws, silky. Cup-shaped ends.
9239	13	.0313	.000769	287	373,210	Diam. .024 = .000452	41.2	2″.35 from jaws, fine silky. Cup-shaped ends.
				285	370,610	Diam. .023 = .000415	46.0	2″.85 from jaws, fine silky. Cup-shaped ends.
				291	378,410	Diam. .023 = .000415	46.0	1″.00 from jaws, fine silky. Cup-shaped ends.
9260*	13	.0313	.000769	272	353,710	Diam. .025 = .000491	36.1	2″.10 from jaws, fine silky. Cup-shaped ends.
9240	14	.0330	.000855	322	376,610	Diam. .026 = .000531	37.9	2″.50 from jaws, fine silky. Cup-shaped ends.
				322	376,610	Diam. .027 = .000573	33.0	3″.90 from jaws, fine silky. Cup-shaped ends.
				321	375,440	Diam. .027 = .000573	33.0	0″.55 from jaws, fine silky. Cup-shaped ends.
9259	14	.0330	.000855	333	389,470	Diam. .028 = .000616	28.0	5″.20 from jaws, silky. Cup-shaped ends.
9241	15	.0352	.000973	358	367,930	Diam. .028 = .000616	36.7	At middle of length, fine silky. Cup-shaped ends.
				368	378,210	Diam. .028 = .000616	36.7	2″.55 from jaws, fine silky. Cup-shaped ends.
				362	372,040	Diam. .027 = .000573	41.1	3″.50 from jaws, fine silky. Cup-shaped ends.
9258*	15	.0352	.000973	359	369,500	Diam. .030 = .000707	27.3	5″.50 from jaws, where the wire was marked by contact with the micrometer fork, silky. Cup-shaped ends.
9242	16	.0369	.001069	402	376,050	Diam. .029 = .000661	38.2	At face of jaws, fine silky. Cup-shaped ends.
				403	376,990	Diam. .029 = .000661	38.2	6″.00 from jaws, fine silky. Cup-shaped ends.
				402	376,050	Diam. .030 = .000707	33.9	1″.60 from jaws, fine silky. Cup-shaped ends.
9257*	16	.0369	.001069	395	369,500	Diam. .028 = .000616	42.4	At face of jaws, silky. Cup-shaped ends.
9243	17	.0389	.001188	435	366,160	Diam. .031 = .000755	36.4	6″.25 from jaws, fine silky. Cup-shaped ends.
				434	365,320	Diam. .031 = .000755	36.4	At middle of length, fine silky. Cup-shaped ends.
				432	363,640	Diam. .031 = .000755	36.4	At face of jaws, fine silky. Cup-shaped ends.
9256*	17	.0389	.001188	432	363,640	Diam. .029 = .000661	44.4	6″.50 from jaws, fine silky. Cup-shaped ends.
9244	18	.0412	.001333	478	358,590	Diam. .032 = .000804	39.7	At middle of length, fine silky. Cup-shaped ends.
				480	360,090	Diam. .032 = .000804	39.7	3″.00 from jaws, fine silky. Cup-shaped ends.
				477	357,840	Diam. .032 = .000804	39.7	6″.50 from jaws, fine silky. Cup-shaped ends.
9255*	18	.0412	.001333	476	357,090	Diam. .031 = .000755	43.4	3″.80 from jaws, silky. Cup-shaped ends.

9245	19	.0430	.001452	520	358, 130	Diam. .034 = .000908	37.5	6″.25 from jaws, fine silky. Cup-shaped ends.
				517	356, 060	Diam. .034 = .000908	37.5	At middle of length, fine silky. Cup-shaped ends.
				518	356, 750	Diam. .034 = .000908	37.5	2″.00 from jaws, fine silky. Cup-shaped ends.
9254*	19	.0430	.001452	518	356, 750	Diam. .033 = .000855	41.1	2″.10 from jaws, fine silky. Cup-shaped ends.
9246	20	.0443	.001541	562	364, 710	Diam. .036 = .001018	33.9	0″.10 from jaws, fine silky. Cup-shaped ends.
				560	363, 400	Diam. .036 = .001018	33.9	2″.15 from jaws, fine silky. Cup-shaped ends.
				562	364, 700	Diam. .036 = .001018	33.9	5″.00 from jaws, fine silky. Cup-shaped ends.
9253*	20	.0443	.001541	556	360, 810	Diam. .034 = .000908	41.1	0″.75 from jaws, silky. Cup-shaped ends.
9247	21	.0463	.001684	584	346, 790	Diam. .036 = .001018	39.5	2″.50 from jaws, fine silky. Cup-shaped ends.
				576	342, 040	Diam. .036 = .001018	39.5	1″.80 from jaws, fine silky. Cup-shaped ends.
				578	343, 230	Diam. .036 = .001018	39.5	0″.90 from jaws, fine silky. Cup-shaped ends.
9252*	21	.0463	.001684	580	344, 410	Diam. .035 = .000962	42.9	At middle of length, silky. Cup-shaped ends.
9248	22	.0478	.001794	607	338, 350	Diam. .037 = .001075	40.1	At face of jaws, fine silky. Cup-shaped ends.
				611	340, 580	Diam. .037 = .001075	40.1	1″.20 from jaws, fine silky. Cup-shaped ends.
				615	342. 810	Diam. .037 = .001075	40.1	At face of jaws, fine silky. Cup-shaped ends.
9251*	22	.0478	.001794	609	338, 460	Diam. .035 = .000962	46.4	5″.10 from jaws, fine silky. Cup-shaped ends.
9249	23	.0513	.002067	607	337, 200	Diam. .039 = .001195	42.2	1″.50 from jaws, fine silky. Cup-shaped ends.
				601	334, 300	Diam. .039 = .001195	42.2	1″.80 from jaws, fine silky. Cup-shaped ends.
				606	336, 720	Diam. .039 = .001195	42.2	1″.65 from jaws, fine silky. Cup-shaped ends.
9250*	23	.0513	.002067	672	325, 110	Diam. .038 = .001134	45.1	3″.00 from jaws, fine silky. Cup-shaped ends.

* Elongations measured on these specimens.

TENSION TESTS OF EYED SAMPLES OF STEEL MUSIC WIRE.

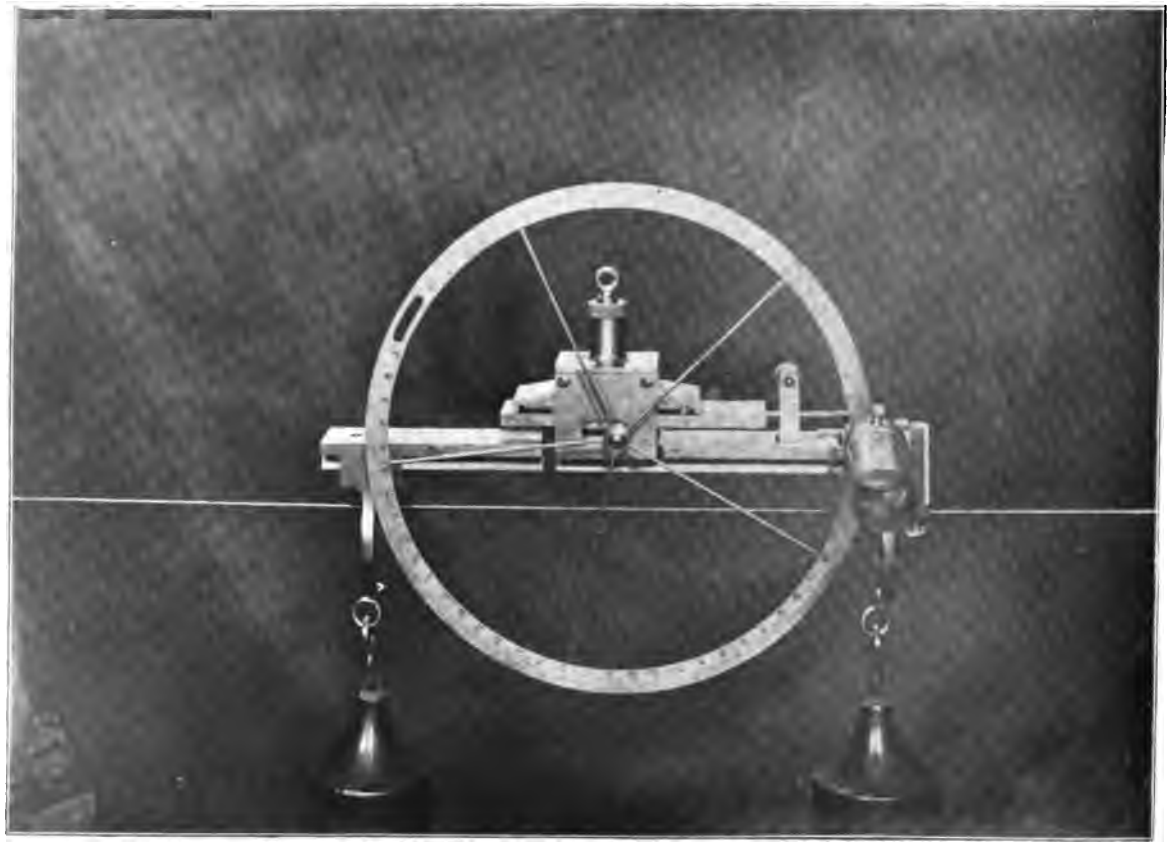
Eyes which were on the several coils when received from the makers of the wire.

No. of test.	No. of gauge.	Pitch of twist of eyes per inch.	Tensile strength.	Fracture.
			Pounds.	
9262	12	7	204	In twisted part, silky. Cup-shaped ends.
9263	13	6½	231	
9264	14	6	269	
9265	15	6½	273	
9266	16	6	306	
9267	17	6	341	
9268	18	5	399	
9269	19	4½	438	
9270	20	4½	468	
9271	21	4½	466	
9272	22	4½	484	
9273	23	5	504	

EYES MADE AT WATERTOWN ARSENAL.

No. of test.	No. of gauge.	Pitch of twist of eyes per inch.	Tensile strength.	Fracture.
			Pounds.	
9274	12	4	224	In twisted part, silky. Cup-shaped ends.
9275	13	3½	263	
9276	14	3½	301	
9277	15	3½	323	
9278	16	3	359	
9279	17	3½	374	
9280	18	3	464	
9281	19	3	492	
9282	20	2½	506	
9283	21	2½	498	
9284	22	2½	560	
9285	23	2½	624	

In the formation of these eyes the two parts of the wire were simply twisted together by the spiral bending of the material, avoiding the torsional stress incident to the usual methods of eyeing wires.



DIAL MICROMETER, IN POSITION ON WIRE FOR MEASURING ELONGATIONS.

TENSION TESTS OF STEEL MUSIC WIRE MADE OVER PINS $\frac{3}{16}$" DIAMETER, REPRESENTING WREST PINS OF PIANOFORTES.

Three turns taken around the pin, the loose end carried through an eye in the pin.

No. of test.	No. of gauge	Tensile strength.	Fracture.
		Pounds.	
9286	12	226	At the pin, silky. Cup-shaped ends.
9287	13	269	
9288	14	294	
9289	15	335	
9290	16	366	
9291	17	399	
9292	18	437	
9293	19	467	
9294	20	501	
9295	21	522	
9296	22	543	
9297	23	619	

TENSILE TESTS WITH DETAILS OF ELONGATIONS AND PERMANENT SETS.

No. 9261.

No. 12 gauge.
Diameter, ".0286.
Sectional area, .000642 square inch.
Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0216	0.	
120	.....	.0283	.....	
140	.....	.0351	.....	
160	.....	.0434	.....	
180	.....	.0516	.....	
200	.....	.0627	.0046	
237	369, 160	.....	.....	Tensile strength.

Fractured at face of jaws. Appearance, silky. Cup shaped ends.
Diameter at fracture, ".023.
Area, .000415 square inch.
Contraction of area, 35.4 per cent.

No. 9260.

No. 13 gauge.
Diameter, ″.0313.
Sectional area, .000769 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0169	.0002	
120	.....	.0228	.....	
140	.....	.0290	.....	
160	.....	.0348	.....	
180	.....	.0419	.....	
200	.....	.0505	.0051	
220	.....	.0600	.....	
272	353,710	.....	.....	Tensile strength.

Fractured 2″.1 from jaws. Appearance, silky. Cup-shaped ends.
Diameter at fracture, ″.025.
Area, .000491 square inch.
Contraction of area, 36.1 per cent.

No. 9259.

No. 14 guage.
Diameter, ″.0330.
Sectional area, .000855 square inch.
Gauged length, 6″.

Applied loads.		In guaged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0167	.0005	
200	.....	.0435	.0017	
220	.....	.0500	.....	
240	.....	.0552	.....	
260	.....	.0613	.....	
280	.....	.0708	.0076	
333	389,470	.....	.....	Tensile strength.

Fractured 5″.2 from jaws. Appearance, silky. Cup-shaped ends.
Diameter at fracture, ″.028.
Area, .000616 square inch.
Contraction of area, 28.0 per cent.

No. 9258.

No. 15 guage.
Diameter, ″.0352.
Sectional area, .000973 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0132	.....	
200	.....	.0361	.0005	
220	.....	.0423	.....	
240	.....	.0475	.....	
260	.....	.0530	.....	
280	.....	.0598	.....	
300	.....	.0670	.0069	
320	.....	.09	.....	
340	.....	.10	.....	
359	369,500	.....	.....	Tensile strength.

Fractured 5″.5 from the jaws where the wire was marked by contact with the micrometer fork. Appearance, silky. Cup-shaped ends.
Diameter at fracture, ″.030.
Area, .000707 square inch.
Contraction of area, 27.3 per cent.

No. 9257.

No. 16 gauge.
Diameter, ″.0369.
Sectional area, .001069 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0123	0.	
200	.....	.0337	.0014	
220	.....	.0389	.....	
240	.....	.0438	.....	
260	.....	.0487	.....	
280	.....	.0546	.....	
300	.....	.0603	.0072	
320	.....	.0748	.....	
340	.....	.0803	.....	
360	.....	.0918	.0248	
395	369,500	.....	.....	Tensile strength.

Fractured at face of jaws. Appearance, silky. Cup-shaped ends.
Diameter at fracture, ″.028.
Area, .000616 square inch.
Contraction of area, 42.4 per cent.

No. 9256.

No. 17 guage.
Diameter, ″.0389.
Sectional area, .001188 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0111	.0001	
200	.....	.0292	0.	
220	.....	.0339	.....	
240	.....	.0371	.....	
260	.....	.0414	.....	
280	.....	.0454	.....	
300	.....	.0506	.0028	
320	.....	.0565	.....	
340	.....	.0611	.....	
360	.....	.0669	.....	
380	.....	.0751	.....	
400	.....	.0859	.0179	
420	.....	.10	.....	
432	363,640	.....	.....	Tensile strength.

Fractured 6″.5 from jaws. Appearance, fine, silky. Cup-shaped ends.
Diameter at fracture, ″.029.
Area, .000661 square inch.
Contraction of area, 44.4 per cent.

No. 9255.

No. 18 gauge.
Diameter, ″.0412.
Sectional area, .001333 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0098	0.	
200	.....	.0269	0.	
300	.....	.0451	.0020	
320	.....	.0494	.....	
340	.....	.0542	.....	
360	.....	.0586	.....	
380	.....	.0640	.....	
400	.....	.0697	.0099	
420	.....	.09	.....	
440	.....	.10	.....	
460	.....	.11	.....	
476	357,090	.....	.....	Tensile strength.

Fractured 3.8″ from jaws. Appearance, silky. Cup-shaped ends.
Diameter at fracture, ″.031.
Area, .000755 square inch.
Contraction of area, 43.4 per cent.

No. 9254.

No. 19 gauge.
Diameter, ″.0430.
Sectional area, .001452 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0089	0.	
200	.....	.0238	0.	
300	.....	.0406	.0018	
320	.....	.0432	.....	
340	.....	.0468	.....	
360	.....	.0510	.....	
380	.....	.0550	.....	
400	.....	.0596	.0067	
420	.....	.0668	.....	
440	.....	.0709	.....	
460	.....	.0776	.0151	
480	.....	.09	.....	
500	.....	.10	.....	
518	356,750	.....	.....	Tensile strength.

Fractured 2″.1 from jaws. Appearance, silky. Cup-shaped ends.
Diameter at fracture, ″.033.
Area, .000855 square inch.
Contraction of area, 41.1 per cent.

No. 9253.

No. 20 gauge.
Diameter, ″.0443.
Sectional area, .001541 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0086	0.	
200	.....	.0235	.0006	
300	.....	.0376	.0011	
320	.....	.0418	.....	
340	.....	.0450	.....	
360	.....	.0482	.....	
380	.....	.0522	.....	
400	.....	.0563	.0056	
420	.....	.0602	.....	
440	.....	.0642	.....	
460	.....	.0696	.....	
480	.....	.0756	.....	
500	.....	.0831	.0173	
520	.....	.10	.....	
540	.....	.12	.....	
556	360,810	.....	.....	Tensile strength.

Fractured ″.75 from face of jaws. Appearance, silky. Cup-shaped ends.
Diameter at fracture, ″.034.
Area, .000908 square inch.
Contraction of area, 41.1 per cent.

No. 9252.

No. 21 gauge.
Diameter, ″.0463.
Sectional area, .001684 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0082	0.	
200	.....	.0207	0.	
300	.....	.0341	.0006	
320	.....	.0374	.....	
340	.....	.0402	.....	
360	.....	.0429	.....	
380	.....	.0461	.....	
400	.....	.0494	.0043	
420	.....	.0539	.....	
440	.....	.0564	.....	
460	.....	.0606	.....	
480	.....	.0642	.....	
500	.....	.0687	.0093	
520	.....	.07	.....	
540	.....	.08	.....	
560	.....	.09	.....	
580	344,416	.12	.....	Tensile strength.

Fractured at middle of length. Appearance, silky. Cup-shaped ends.
Diameter at fracture, ″.035.
Area, .000962 square inch.
Contraction of area, 42.9 per cent.

No. 9251.

No. 22 gauge.
Diameter, ″.0478.
Sectional area, .001794 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0071	0.	
200	.....	.0192	.0006	
300	.....	.0321	.0016	
320	.....	.0346	.....	
340	.....	.0374	.....	
360	.....	.0401	.....	
380	.....	.0431	.....	
400	.....	.0463	.0040	
420	.....	.0499	.....	
440	.....	.0531	.....	
460	.....	.0570	.....	
480	.....	.0610	.....	
500	.....	.0652	.0092	
520	.....	.0706	.....	
540	.....	.0760	.....	
580	.....	.09	.....	
600	.....	.12	.....	
609	339,460	.....	.....	Tensile strength.

Fractured 5″.1 from jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.035.
Area, .000962 square inch.
Contraction of area, 46.4 per cent.

No. 9250.

No. 23 gauge.
Diameter, ″.0513.
Sectional area, .002067 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
60	.....	.0026	.....	
80	.....	.0049	.....	
100	.....	.0071	.....	
120	.....	.0091	.....	
140	.....	.0111	.....	
160	.....	.0135	.....	
180	.....	.0156	.....	
200	.....	.0173	.0008	
220	.....	.0201	.....	
240	.....	.0221	.....	
260	.....	.0245	.....	
280	.....	.0266	.....	
300	.....	.0290	.0019	
320	.....	.0319	.....	
340	.....	.0338	.....	
360	.....	.0361	.....	
380	.....	.0389	.....	
400	.....	.0415	.0048	
420	.....	.0456	.....	
440	.....	.0480	.....	
460	.....	.0510	.....	
480	.....	.0537	.....	
500	.....	.0571	.0098	
520	.....	.0656	.....	
540	.....	.0687	.....	
560	.....	.0719	.....	
580	.....	.0769	.....	
600	.....	.0820	.0231	
620	.....	.09	.....	
640	.....	.10	.....	
660	.....	.12	.....	
672	325,110	.....	.....	Tensile strength.

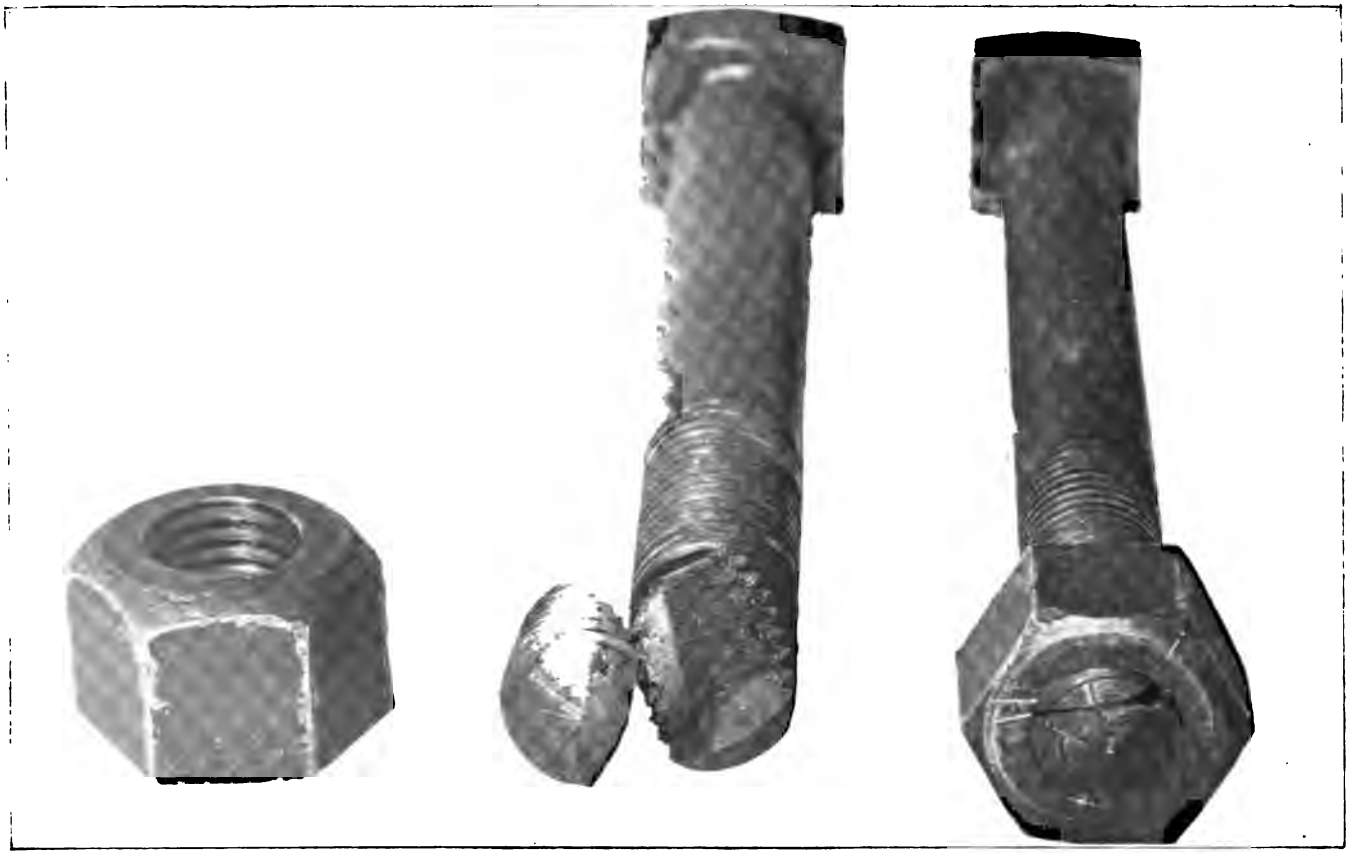
Fractured 3″ from face of jaws. Appearance, fine silky. Cup shaped ends.

Diameter at fracture, ″.038.
Area, ″.001134 square inch.
Contraction of area, 45.1 per cent.

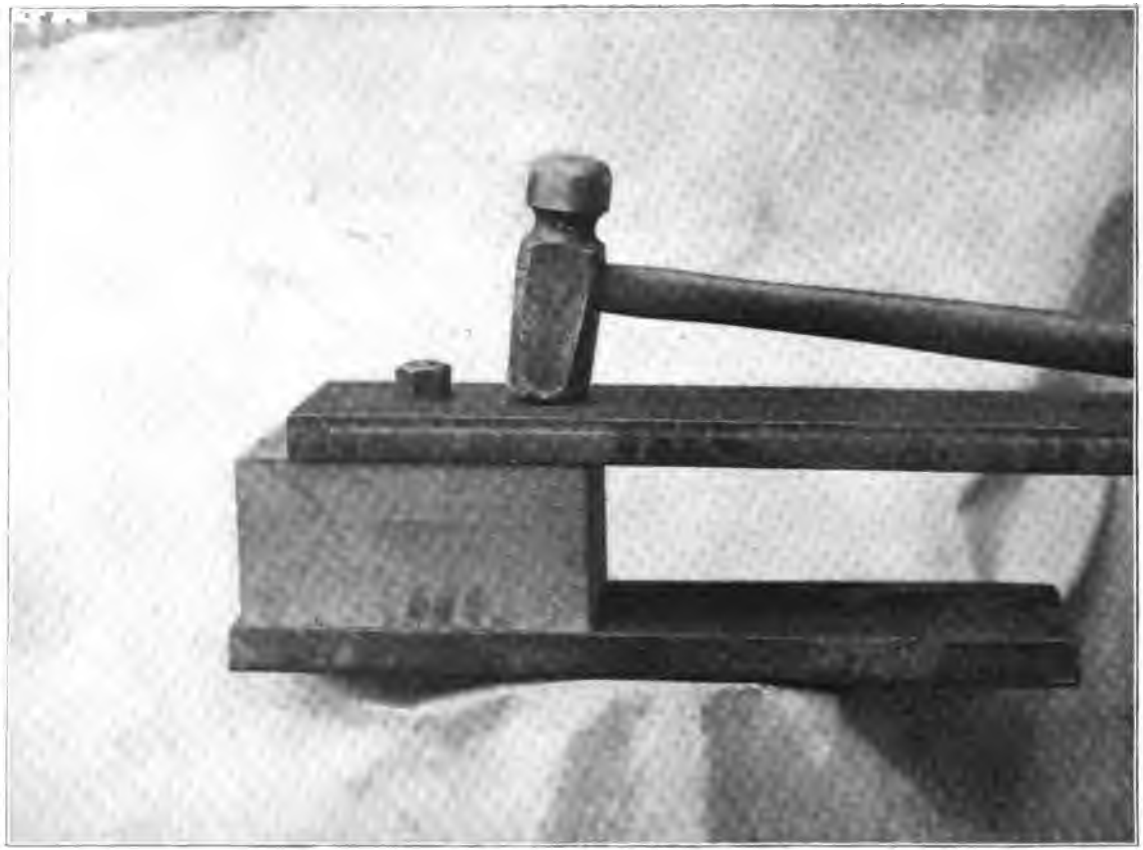
TENSION TESTS OF HARD BRASS AND GALVANIZED IRON WIRE.

No. of test.	Description.	Diameter.	Sectional area.	Tensile strength. Total.	Tensile strength. Per square inch.	Area at fracture.	Contraction of area.	Fractured.
		Inch.	*Sq. inch.*	*Pounds.*	*Pounds.*	*In. Sq. in.*	*Per cent.*	
9300	Hard brass wire	.1096	.009433	1,102	116,820	Diam. .100 = .007854	16.7	".95 from jaws. Silky, oblique. Spongy.
				1,129	119,690	Diam .090 = .006367	32.6	".95 from jaws. Silky.
				1,146	121,490	Diam. .080 = .005026	46.7	In the jaws. Silky.
9301	Hard brass wire	.1628	.020813	2,298	110,410	Diam. .113 = .010028	51.8	In the jaws. Silky.
				2,283	109,690	Diam. .118 = .010936	47.5	".4 from jaws. Silky.
				2,296	110,320	Diam. .115 = .010387	50.1	In the jaws. Silky.
9302	Galvanized iron wire	.2000	.031416	2,051	65,280	Diam. .135 = .014314	54.4	3" from jaws. Fibrous.
				2,044	65,060	Diam. .130 = .013273	57.7	"7.6 from jaws. Fibrous.
				2,033	64,710	Diam. .127 = .012668	59.7	"10.1 from jaws. Fibrous.

VIBRATION PROOF BOLTS AND NUTS.



"VIBRATION PROOF" BOLTS AND NUTS.



"VIBRATION PROOF" BOLT AND NUT AND WOOD FILLING PIECE.

"VIBRATION PROOF" BOLTS AND NUTS.

Two bolts were received for test from the Vibration Proof Nut Company, New York; a $\frac{3}{4}''$ bolt, 8" long, threaded 10 per inch, and a $\frac{7}{8}''$ bolt, 7" long, threaded 9 per inch.

The $\frac{3}{4}''$ bolt was tagged "Sample of bolt used on truck of Pullman Palace Car Co., Pullman, Ill." The $\frac{7}{8}''$ bolt was tagged "Sample of bolt used at Watervliet Arsenal, West Troy, N. Y."

These bolts were each fitted with a locking segment, which is the peculiar feature of the device intended to resist vibratory effects.

The segments were about $\frac{3}{4}''$ long and were fitted to the ends of the bolts, which were cut away at the threaded ends by a plane oblique to the axis of the bolt.

The nuts closely fitted the bolts. The nut on the $\frac{3}{4}''$ bolt could, however, be turned on with the hand, whereas the nut on the $\frac{7}{8}''$ bolt required a pull of 45 pounds on a 12" wrench to screw it on.

The $\frac{3}{4}''$ bolt was first examined, for which purpose a weight of 460 pounds was suspended from the bolthead. The bolt passed through a clearance hole in an iron bar transversely supported, the nut and locking segment being on the upper side of the iron bar, thus sustaining the weight below.

The nut was screwed on until all of the threads in the nut were engaged with those of the bolt.

The iron bar was then set into vibration by rapid blows of a $1\frac{1}{4}$-pound hand hammer delivered in the vicinity of the bolt, but not striking the latter.

In the operation of the locking segment it appears to be necessary to back off the nut a certain amount in order to bring the locking segment into action. When this backing off was done in a vise the segment became operative upon retracting the nut one-eighth of a turn.

The first test was made to determine whether the locking segment would move to an operative position while the nut was being backed off as the result of vibratory action.

The iron bar was jarred by means of hammer blows, a second hammer at times being used, striking slowly and not rhythmical with the first hammer.

Proceeding in this manner the nut was backed off a full turn without the locking segment in the meantime assuming an operative position.

The locking segment did not in this time perceptibly move from its unlocked position.

The nut was again screwed on, and then with a 15" wrench, used for backing off the nut, the locking segment was brought into an operative position.

Jarring the iron bar resulted in the prompt release of the locking segment and a renewal of the backing off of the nut.

This experiment was repeated a number of times. It was found that eight hammer blows on the iron bar were sufficient to release the segment from its locked position and return it to its so-called natural or unlocked position.

The 460-pound weight was now removed and a short piece of gas pipe placed over the bolt and between the iron bar and the head of the bolt. The bolt was tightened against this piece of gas pipe, and the nut then backed off with a wrench sufficiently to bring the locking segment into action. The elasticity of the bolt and the gas pipe was suf-

ficient to retain the latter firmly gripped after this slight backing off of the nut.

The iron bar was jarred as before, upon which the segment unlocked and the bolt became loose.

The bolt was now removed from the transversely supported iron bar.

It was next used for bolting together two heavier iron bars, between which were placed filling plates of boiler-plate steel.

The nut was set up with as much force as a man could readily exert using a 15″ wrench, and then the nut was backed off with a wrench sufficiently to bring the locking segment into action.

This combination of bars and plates was now jarred by means of a 6½-pound hammer, whereupon the locking segment unlocked and returned to its unlocked position. Continuing the jarring, the nut backed off, loosening slightly the bars and filling pieces.

An oak-wood block was next substituted for the boiler-plate filling pieces, the nut was set up as before, and backed off with a wrench sufficiently to bring the locking segment into action.

The bar under the nut was jarred by means of the 6½-pound hammer as before, and the same result followed; that is, the locking segment unlocked and returned to its natural position. There was in addition a slight backing off of the nut. The test of this bolt was then discontinued.

At the close of this examination the nut was not so tight on the thread as in the first instance.

The ⅞″ bolt was next examined.

The nut was partially screwed on, assembling the attachments for suspending the 460-pound weight of the first test.

Finally the nut was screwed on until all the threads engaged with the bolt. It required 50 pounds pull on a 12″ wrench to start turning on the nut and 45 pounds pull to continue and complete screwing it on.

The 460-pound weight was shackled to the attachments, the nut then backed off with a wrench until the locking segment was brought into action.

Vibration of the bar by means of hammer blows now began. The segment immediately unlocked and returned to its natural position, thus apparently bringing the "vibration-proof" bolt into the condition of a common bolt.

Continued hammering failed to back off the nut from the bolt. Thus it appeared that while the amplitude of the vibrations caused by the hammer blows was sufficient to unlock the segment, it was not sufficient to cause the backing off of a nut fitting tightly to the thread of a bolt.

In order to make a more complete demonstration of this point, a common bolt ¾″ diameter, 10 threads per inch, was prepared with a tight-fitting nut.

The same attachments were used as before for suspending the 460-pound weight.

The nut of the bolt was screwed on with a pull of 50 pounds on a 12″ wrench. Under the conditions of the preceding test the nut failed to back off from the bolt.

The examination of the ⅞″ vibration-proof bolt was resumed, bolting together the two heavy iron bars and the oak-wood block previously referred to.

The nut was screwed on firmly, then backed off with a wrench sufficiently to bring the locking segment into operative position, the elasticity of the wooden block still keeping the bolt under tension.

The bar under the nut was jarred with hammer blows, whereupon the locking segment unlocked and returned to its natural position. The hammering was continued, resulting in a slight backing off of the nut on the bolt. The test was then discontinued.

A final examination of this bolt showed that the nut now fitted less closely than in the previous instance and that it could be backed off with a 12″ wrench without special difficulty.

The resistance against backing off ranged from 20 to 32 pounds on a 12″ wrench, which was further reduced to 15 to 20 pounds after unscrewing the nut six times, the locking segment being in place during the time.

The series of observations was completed by bolting together the heavy iron bars and the oak-wood filling block with the common ¾″ bolt, the nut still working very tightly on the thread.

This resisted the vibratory effects of the hammer blows and did not back off perceptibly during a prolonged interval of hammering.

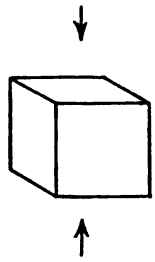
GRANITE AND SANDSTONE.

GRANITE AND SANDSTONE.

Granite from Stone Mountain, Ga., and Pine Mountain Quarries, Lithonia, Ga.

Material furnished by the United States Geological Survey, Division of Mineral Resources.

COMPRESSION TESTS OF GRANITE FROM STONE MOUNTAIN, GA.

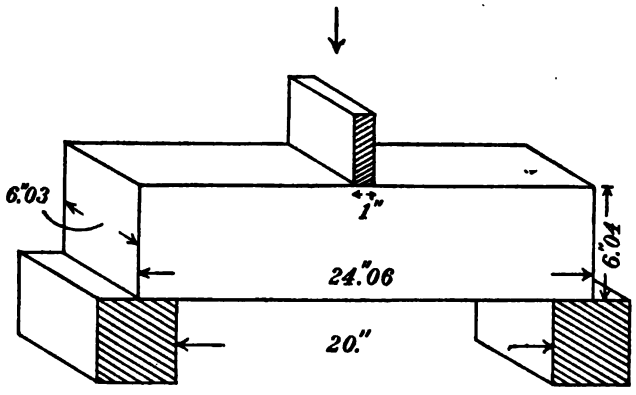


No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
		Height.	Compressed surface.				Total.	Per square inch.
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
8830	1	3.40	3.38	3.37	11.39	168,000	168,400	14,785
8831	1	3.53	3.54	3.53	12.50	157,000	211,200	16,896
8832	1	3.79	3.75	3.76	14.10	168,000	176,400	12,511
8833	2	3.98	3.91	3.92	15.33	335,800	335,800	21,905
8834	2	4.07	4.04	4.06	16.40	348,000	362,100	22,079
8835	2	3.77	3.80	3.76	14.29	304,000	310,900	21,756
8836	3	3.59	3.57	3.57	12.74	272,000	272,000	21,350
8837	3	3.83	3.84	3.84	14.75	312,000	321,300	21,783
8838	3	4.05	4.02	4.04	16.97	323,000	364,200	21,461
8956	8	4.05	4.02	4.01	16.12	396,000	403,300	25,020
8957	8	4.04	4.02	4.03	16.20	413,100	413,100	25,500
8958	8	4.05	4.01	4.02	16.12	418,800	431,500	26,770
8859	No mark.	4.05	4.05	4.01	16.24	305,500	305,500	18,810
8960	No mark.	2.05	2.04	2.01	4.10	92,580	92,580	22,580

Pyramidal fractures.

TRANSVERSE TEST OF GRANITE FROM STONE MOUNTAIN, GA.

No. 487.



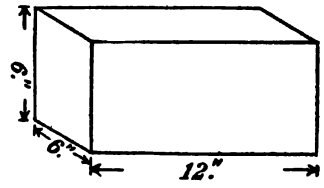
Ultimate strength 19,140 pounds.

Modulus of rupture, R = 2,610 pounds per square inch.

COEFFICIENT OF EXPANSION OF GRANITE FROM STONE MOUNTAIN, GA.

One-half of fractured transverse specimen No. 487.

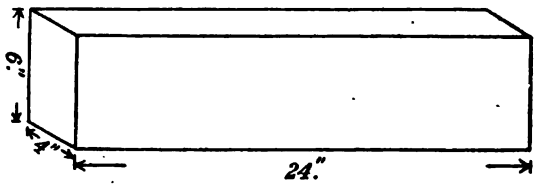
Approximate dimensions.



Treatment.	Temperature.	Ganged length.	Coefficient of expansion.
	°F.	*Inches.*	*Inch.*
In cold-water bath	33	10.0009	
In hot-water bath	212	10.0080	} =.00000375
In cold-water bath	33	10.0016	
The wet stone inclosed in water-tight brass case, and exposed in freezing mixture of ice and salt four hours	25 ±	10.0014	
In cold-water bath	33	10.0019	

SAMPLE TAKEN FROM ABANDONED QUARRY ON SOUTHEASTERN SIDE OF STONE MOUNTAIN, GA.

Represents stone used in the capitol, Atlanta, Ga.



Treatment.	Temperature.	Ganged length.	Coefficient of expansion.
	° F.	*Inches.*	*Inch.*
In open air	70	20.0165	
In cold-water bath	33	20.0155	
In hot-water bath	212	20.0322	} =.00000418
In cold-water bath	33	20.0172	
The wet stone placed in a brass case, and then packed with mixture of ice and salt around it. In this manner the stone was exposed to a temperature below freezing for a period of eight hours on two occasions.			
After the second exposure and while at a temperature below 25° F	Below 25	20.0214	
In cold-water bath	33	20.0180	

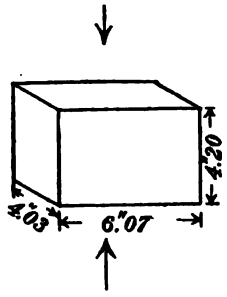
GRANITE FROM PINE MOUNTAIN QUARRIES, LITHONIA, GA.

COMPRESSION TESTS.

No. of test.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
	Height.	Compressed surface.				Total.	Per square inch.
	Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*
9205	3.50	3.52	3.51	12.35	310,000	336,900	27,279
9206	3.99	4.01	4.02	16.12	386,000	428,600	26,588
9207	4.01	4.01	4.01	16.08	422,000	471,900	29,347

SANDSTONE CONTRIBUTED BY THE VICTOR SANDSTONE COMPANY CHITWOOD, OREG.

No. 10086.



Sectional area, 4″.03 by 6″.07 = 24.46 square inches.

First crack at 145,000 pounds. Ultimate strength, 153,700 pounds = 6,284 pounds per square inch.

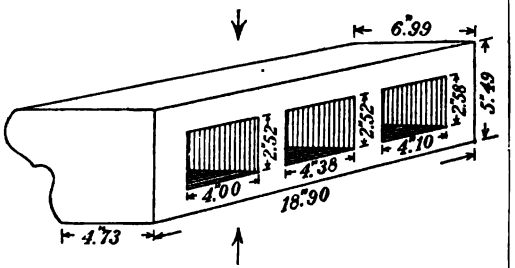
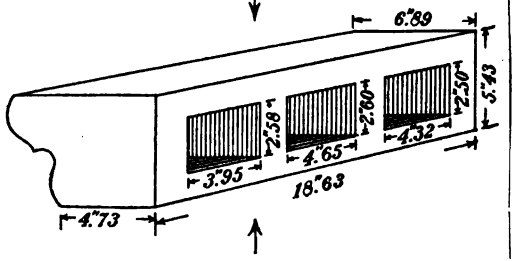
Pyramidal fracture.

		Per cent.
Chemical composition	Silica	72.45
	Oxide of iron	10.80
	Alumina	12.60
	Lime	4.10
	Magnesia	Trace.

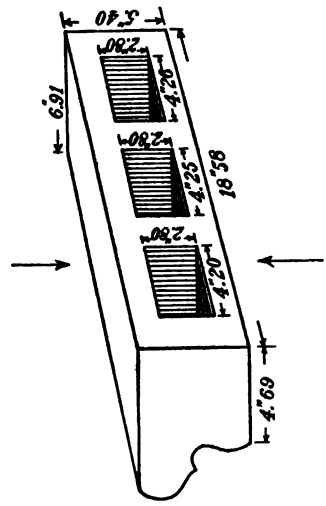
BRICKS AND TERRA COTTA.

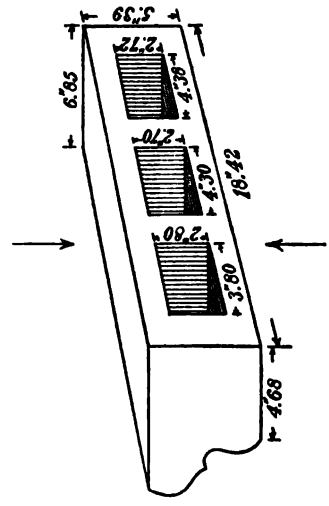
Compression Tests of Architectural Terra Cotta and Bricks. Material Contributed by Gladding, McBean & Co., San Francisco, Cal.

COMPRESSION OF TERRA COTTA.

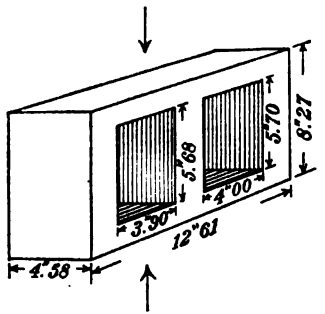
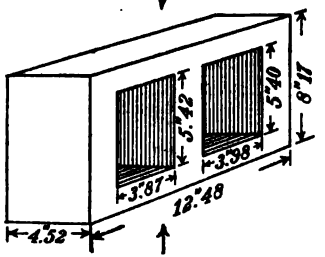
No. of test.	Shape.	Color.	Weight.	Compressed surface.	Sectional area.	First crack.	Ultimate strength.		Remarks.
							Total.	Per square inch.	
			Lbs. Oz.	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
8867		White.....	31 0	4.73 x 18.90	89.40	159,900	159,900	1,789	
8868		Buff.....	31 4	4.73 x 18.63	88.12	144,000	163,700	1,858	

8869	Salmon	30	4	4.69 x 18.58	87.14	156,100	156,100	1,791	The cored holes did not extend through the samples, the fronts exposing full faces.
8870	Red	28	8	4.68 x 18.42	86.21	137,050	137,050	1,500	

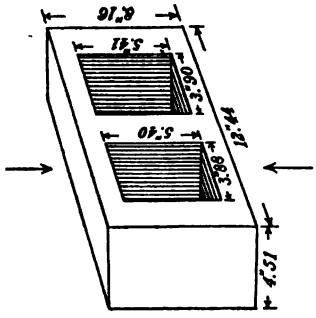




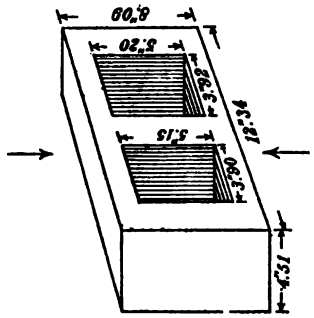
Compression tests of architectural terra cotta and bricks—Continued.

No. of test.	Shape.	Color.	Weight.	Compressed surface.	Sectional area.	First crack.	Ultimate strength.		Remarks.
							Total.	Per square inch.	
			Lbs. Oz.	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
8871		White.....	21	4.58 x 12.61	57.75	98,300	98,300	1.702	
8872		Buff.....	22	4.52 x 12.48	56.41	107,200	132,200	2,343	

Salmon.....	21	8	4.51 x 12.44	56.10	88,000	100,400	1,789
Red.....	20	14	4.51 x 12.34	55.65	85,900	102,700	1,845

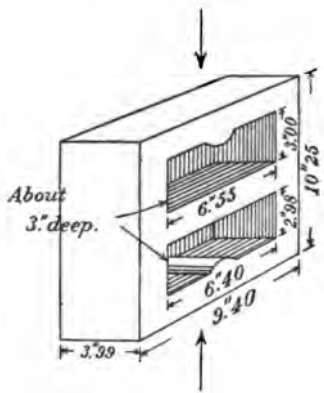


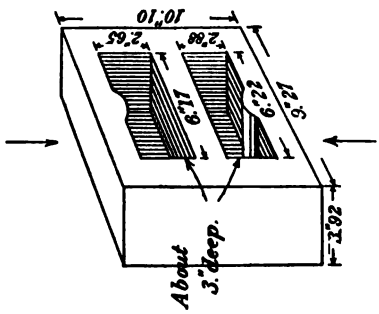
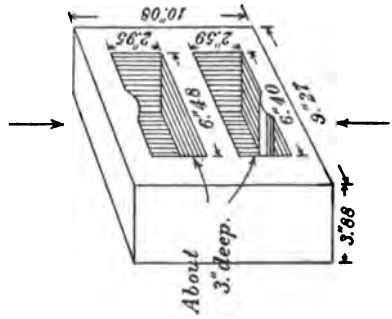
8873



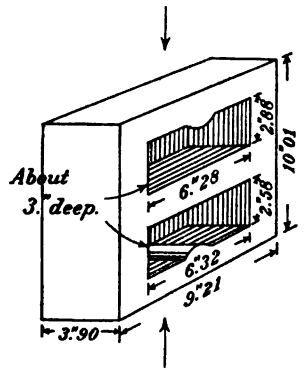
8874

Compression tests of architectural terra cotta and bricks—Continued.

No. of test.	Shape.	Color.	Weight.	Compressed surface.	Sectional area.	First crack.	Ultimate strength.		Remarks.
							Total.	Per square inch.	
			Lbs. Oz.	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
8875		White	18 3	3.99 x 9.40	37.51	68,100	68,100	1,815	

8876		Buff	18	6¼	3.92 x 9.27	36.34	58,900	74,600	2,063
8877		Salmon	17	10	3.88 x 9.24	35.85	63,800	71,400	1,992

Compression tests of architectural terra cotta and bricks—Continued.

No. of test.	Shape.	Color.	Weight.	Compressed surface.	Sectional area.	First crack.	Ultimate strength.		Remarks.
							Total.	Per square inch.	
			Lbs. Oz.	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
8878		Red.....	18 0	3.90 x 9.21	35.92	58,900	67,900	1,890	

COMPRESSION OF BRICKS.

No. of test.	Description.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
		Height.	Compressed surface.				Total.	Per square inch.
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
8841	Buff color, No. 38.	2.50	4.04	8.17	33.01	176,000	251,200	7,594
8842	.....do.....	2.47	3.96	8.16	32.31	211,000	270,700	8,378
8843	.....do.....	2.47	3.93	8.18	32.15	156,000	270,900	8,426
8844 *a*	.....do.....	4.07	2.40	8.12	19.49	113,600	113,600	5,829
8845 *a*	.....do.....	4.06	2.41	8.15	19.64	117,300	117,300	5,972
8846	White enameled..	2.87	4.47	9.07	40.54	*b* 199,500	205,900	5,076
8847	.....do.....	2.91	4.51	9.10	41.04	*b* 157,000	187,900	4,578
8848	.....do.....	2.89	4.51	9.09	41.00	154,000 *b* 157,000	194,600	4,746
8849	.....do.....	2.88	4.49	9.06	40.68	*b* 186,000	194,200	4,774
8850	.....do.....	2.87	4.49	9.07	40.72	182,000	184,500	4,531
8851	.....do.....	2.90	4.48	9.06	40.59	169,000 *b* 178,000	190,800	4,700

a Bricks tested on edge.
b Enamel cracked.

The sunken panels in the enameled bricks were filled with Portland cement, which was allowed to set one month before testing. The faces were leveled with plaster of paris immediately before testing.

Compression Tests of Half Bricks after Fracture by Transverse Loads.

TESTED DRY.

No. of test.	Description.	Transverse test No.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
			Height.	Compressed surface.				Total.	Per square inch.
			Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
8884	Buff.....	478	2.40	4.09	3.94	16.11	121,000	132,200	8,206
8885	.....do.....	479	2.40	4.33	4.04	17.49	132,900	134,700	7,701

HALF BRICKS TESTED WET.

[Immersed in cold water, which was increased in temperature to 212° F. by admission of steam, then allowed to cool to about 65° F. in the bath. Total time of immersion, 16 hours.]

8891	Buff.....	478	2.40	4.04	3.94	15.92	109,900	109,900	6,903
8892	.....do.....	479	2.40	3.83	4.04	15.47	102,000	111,500	7,207

ADDITIONAL SPECIMENS OF ARCHITECTURAL TERRA COTTA AND BRICKS, CONTRIBUTED BY GLADDING, MCBEAN & CO., SAN FRANCISCO, CAL.

TERRA COTTA CUBES.

Compressed surfaces faced with plaster of paris.

No. of test.	Description.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
9211	Brown terra cotta, muffle burned, same as accepted for the Hall of Justice. No. 25. 12=13—1896.	4.00	3.92	4.01	15.72	46,900	46,900	2,983	
9212		4.00	3.94	4.02	15.84	50,140	50,140	3,165	
9213		3.93	4.02	4.03	16.20	33,100	50,200	3,099	
9214	Buff terra cotta, muffle burned, same as being made for the Affiliated College buildings.	4.03	3.98	4.02	16.00	42,080	43,500	2,719	
9215		4.02	3.98	4.04	16.08	47,410	47,410	2,948	
9216		4.01	4.05	3.98	16.12	44,100	44,100	2,736	
9217	White buff terra cotta, same as the Whittel Building	4.00	4.00	3.91	15.64	48,700	48,700	3,114	
9218		3.92	4.00	4.01	16.04	49,200	49,200	3,067	
9219		4.01	3.92	4.00	15.68	41,850	41,850	2,669	
	BRICKS.								
9220	Standard size, semi-dry, open-kiln burned, brown brick, No. 1, Aug. 22, 1896.	2.50	4.13	8.33	34.40	158,400	176,400	5,128	
9221		2.49	4.12	8.31	34.24	155,000	178,100	5,201	
9222		2.51	4.15	8.36	34.69	121,000	133,900	3,860	
9223	Standard size, semi-dry, open-kiln burned, brown brick, No. 2, Aug. 22, 1896.	2.49	4.11	8.33	34.23	163,000	173,200	5,060	
9224		2.50	4.10	8.33	34.15	154,000	171,900	5,034	
9225		2.50	4.12	8.34	34.36	169,800	177,500	5,166	
9226	Standard size, semi-dry, open-kiln burned, brown brick, No. 3, Aug. 22, 1896.	2.48	4.10	8.30	34.03	189,000	216,500	6,362	
9227		2.50	4.09	8.28	33.86	204,000	232,550	6,868	
9228		2.49	4.10	8.33	34.15	178,800	221,400	6,483	

TRANSVERSE TESTS.

Bricks contributed by Gladding, McBean & Co., San Francisco, Cal.

No. of test.	Description.	Distance between end supports.	Dimensions.		Ultimate strength.	
			Breadth.	Depth.	Total.	Modulus of rupture, R.
		Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*
478	Buff color	6	3.94	2.40	2,401	952
479	.....do	6	4.04	2.40	2,195	849

Modulus of rupture computed by the formula

$$R=\frac{3\,Pl}{2bd^2}$$

SHEARING TESTS.

Bricks contributed by Gladding, McBean & Co., San Francisco, Cal.

No. of test.	Description.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
					Total.	Per square inch.	
		Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
485	Buff color	3.91×2.40×2	18.77	2,800	19,600	1,044	Two.
486	.....do	3.97×2.38×2	18.90	2,400	21,800	1,153	Do.

COMPRESSION TESTS.

Bricks contributed by the Akron Hydraulic Press Brick Company, Cleveland, Ohio.

No. of test.	Description.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
		Height.	Compressed surface.				Total.	Per square inch.
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
8852	Shade 1	2.42	8.25	4.12	33.99	264,000	368,000	10,827
8853	.....do	2.43	8.25	4.09	33.74	239,000	339,100	10,050
8854	.....do	2.45	8.27	4.13	34.15	190,000	305,200	8,937
8839	Shade 2	2.34	8.23	4.10	33.74	399,000	472,600	14,007
8855	Shade 4	2.38	8.06	3.97	32.00	299,000	464,700	14,522
8856	.... do	2.39	8.10	3.97	32.16	294,000	392,900	12,217
8857	.....do	2.41	8.08	3.97	32.08	323,000	446,200	13,909
8858	Shade 8	2.36	8.02	3.98	31.92	365,000	427,900	13,405
8859	.....do	2.36	8.02	3.98	31.92	410,000	509,400	15,959
8860	.....do	2.35	8.00	3.99	31.92	318,000	479,900	15,034
8861	Shade 12	2.35	8.02	3.96	31.76	424,000	592,800	18,665
8862	.....do	2.33	8.01	3.97	31.80	471,000	617,100	19,405
8863	.....do	2.33	8.04	3.98	32.00	370,000	580,600	18,144
8840	Shade 16	2.33	8.01	3.99	31.96	405,000	648,100	20,278
8864	.....do	2.37	8.00	3.97	31.76	448,000	627,500	19,757
8865	.....do	2.32	7.97	3.98	31.72	291,000	a800,000	25,220
8866	.....do	2.32	8.04	3.98	32.00	474,000	647,000	20,219

a Brick not fractured; sustained the maximum load of the testing machine.

COMPRESSION TESTS OF HALF BRICKS AFTER FRACTURE BY TRANSVERSE LOADS.

TESTED DRY.

No. of test.	Marks.	Transverse test No.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
			Height.	Compressed surface.				Total.	Per square inch.
			Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
8879	Shade 1 ...	473	2.36	4.06	4.09	16.60	158,000	167,600	10,096
8880	Shade 4 ...	474	2.35	4.06	3.96	16.08	175,000	196,500	12,220
8881	Shade 8 ...	475	2.32	4.73	3.98	18.82	206,000	255,800	13,592
8882	Shade 12 ..	476	2.30	4.83	3.97	19.17	275,000	360,600	18,811
8883	Shade 16 ..	477	2.31	4.82	3.96	19.09	329,000	381,800	20,000

HALF BRICKS TESTED WET.

[Immersed in cold water, which was increased in temperature to 212° F. by admission of steam, then allowed to cool to about 65° F. in the bath. Total time of immersion, 16 hours.]

8886	Shade 1 ...	473	2.36	4.18	4.09	17.10	139,000	180,200	10,538
8887	Shade 4 ...	474	2.35	4.03	3.96	15.96	182,000	191,100	11,974
8888	Shade 8 ...	475	2.32	3.31	3.98	13.17	106,000	160,900	12,217
8889	Shade 12 ..	476	2.30	3.21	3.97	12.74	173,000	216,500	16,993
8890	Shade 16 ..	477	2.31	3.15	3.96	12.47	78,000	262,400	21,042

TRANSVERSE TESTS.

Bricks contributed by the Akron Hydraulic Press Brick Company, Cleveland, Ohio.

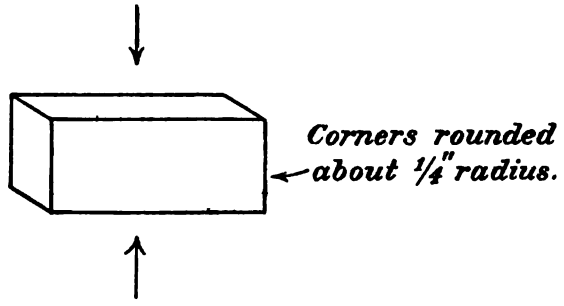
No. of test.	Description.	Distance between end supports.	Dimensions.		Ultimate strength.	
			Breadth.	Depth.	Total.	Modulus of rupture, R.
		Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*
473	Shade 1	6	4.09	2.36	3,664	1,447
474	Shade 4	6	3.96	2.35	3,604	1,483
475	Shade 8	6	3.98	2.32	4,138	1,739
476	Shade 12	6	3.97	2.30	5,160	2,211
477	Shade 16	6	3.96	2.31	4,998	2,127

Shearing Tests.

Bricks contributed by the Akron Hydraulic Press Brick Company, Cleveland, Ohio.

No. of test.	Description.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
					Total.	Per square inch.	
		Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
480	Shade 1	4.10×2.41×2	19.76	6,410	25,900	1,311	Two.
481	Shade 4	3.96×2.35×2	18.61	7,000	25,200	1,354	Do.
482	Shade 8	3.97×2.34×2	18.58	5,400	29,100	1,566	One.
483	Shade 12	3.96×2.33×2	18.45	9,600	41,700	2,260	Do.
484	Shade 16	3.96×2.31×2	18.29	9,000	55,400	3,029	Two.

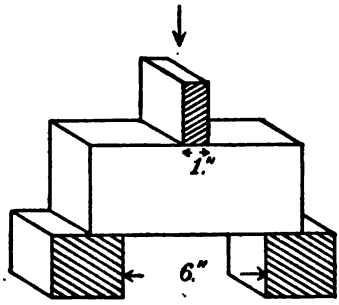
Compression Tests of Paving Bricks from the Portland Stoneware Company, Portland, Me.



Bricks tested on edge.

No. of test.	Description.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
		Height.	Compressed surface.				Total.	Per square inch.
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
9229	Light burnt	3.88	3.21	8.99	28.86	102,000	197,100	6,829
9230	do	3.87	3.24	9.02	29.22	135,000	210,200	7,193
9231	do	3.90	3.21	8.99	28.86	121,000	162,100	5,616
9232	Medium burnt	3.88	3.19	8.93	28.49	118,000	260,800	9,154
9233	do	3.95	3.22	8.99	28.95	78,000	122,100	4,217
9234	do	3.88	3.22	8.99	28.95	117,000	244,200	8,435
9235	Dark brown	3.93	3.26	9.05	29.50	136,000	212,100	7,190
9236	do	3.27	3.27	9.04	29.56	124,000	207,500	7,019
9237	do	3.27	3.27	9.10	29.94	136,000	206,900	6,910

TRANSVERSE TESTS OF PAVING BRICKS FROM THE PORTLAND STONEWARE COMPANY, PORTLAND, ME.



No. of test.	Description.	Distance between end supports.	Dimensions.		Ultimate strength.	
			Breadth.	Depth.	Total.	Modulus of rupture, R.
		Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*
488	Light burnt	6	3.21	3.88	13,120	2,444
489	do	6	3.18	3.90	5,720	1,064
490	Medium burnt	6	3.22	3.89	7,140	1,319
491	do	6	3.19	3.88	7,830	1,468
492	Dark brown	6	3.14	3.85	7,320	1,416
493	do	6	3.21	3.90	6,980	1,287

CONCRETE COLUMNS AND CUBES.

CONCRETE MIXING MACHINE.

COMPRESSION TESTS OF CONCRETE CUBES AND COLUMNS.

Forty-eight specimens are included in this series of tests. Of this number, thirty-eight were contributed by the Aberthaw Construction Company, Boston, Mass., and ten by Sooysmith & Co., New York.

The specimens furnished by the Aberthaw Construction Company were in two principal series, each having a composition of 1 cement, 3 sand, and 6 broken stone, one series having been mixed by hand and the other by machine.

The specimens were 12″ by 12″ in cross-section dimensions, and ranged in height from 2 feet to 14 feet. Their ages when tested were from 34 to 48 days.

There was an additional series of machine-mixed columns in which different mixtures of concrete were used, the proportions of cement, sand, and broken stone, together with the principal series being—

1 : 3 : 6
1 : 4 : 8
1 : 5 : 10
1 : 6 : 12
1 : 7 : 13

There were also two columns having four longitudinal bars of ¾″ square twisted steel, embedded about 2″ from the sides, in each for the purpose of strengthening them.

The columns were built in one of the arsenal storehouses by experienced men in the employ of the Aberthaw Construction Company, following ordinary working conditions of construction.

They were made in vertical molds, which were filled continously and set as one mass. A spade was used against the faces of the molds to bring the mortar to the surfaces and secure full corners, the concrete also being tamped.

Alsen's Portland cement was used throughout, the sand was from a pit near the arsenal, and the broken stone a red trap rock from quarries in Waltham, Mass.

The manner of mixing the hand-made concrete was as follows: Six barrels of broken stone were spread out evenly and covered with three barrels of sand and one barrel of cement.

These were turned dry twice with shovels, and subsequently small portions, as required, were wet and turned at least four times.

On December 3, 1896, the 2, 4, 6, and 8 foot columns were made, and on December 4 the 10, 12, and 14 foot columns.

The molds were removed December 18 and 19, and four days later the surface porosity of some of the columns was plastered with neat cement.

The columns with machine-mixed concrete were built between the dates of February 17 and 20, 1897.

A rotary drum mixer, shown by the accompanying photograph, was used, making about ten rotations per minute.

Into this machine the water was first put, then the stone, which was followed by the sand, and finally by the cement.

The machine was operated from five to ten minutes with each charge of concrete, buckets within the drum turning the concrete while the machine rotated.

The columns of hand-mixed concrete ranged in compressive strength from 844 to 1,072 pounds per square inch, while the machine-mixed

specimens of the same composition, 1:3:6, ranged from 807 to 1,500 pounds per square inch. The machine-mixed concrete gave the higher average strength.

The columns failed by the direct crushing of the material. It was not apparent that the ultimate strength nor the location of fractures were directly influenced by their heights.

Micrometer observations on the compressibility of the material and the permanent sets developed were taken on all columns 6 feet and upward in height.

Individually, columns of the same composition showed considerable variation in the total compression of the material and in resilience. Comparing the mean results of ten hand-mixed and ten machine-mixed columns of the composition 1:3:6, more uniform results are found, and the compressibility of these two series are nearly the same up to loads of 500 pounds per square inch. Above this limit the hand-mixed columns compressed the more rapidly.

The leaner mixtures generally showed greater compressibility and also greater resilience than the richer ones, although there are conspicuous exceptions to this statement.

The moduli of elasticity were computed and for this purpose the sets were deducted from the total compressions; that is, basing the computations on the resilience of the column in each instance.

There is a tendency toward the development of lower moduli of elasticity as the compression loads increased. These results are exhibited in tabular form.

In the details of the tests the figures showing the compression of the material and the sets are from observations taken immediately after the loads were applied or released as the case might be.

There is a sluggish response of the material to variations in load, which becomes particularly noticeable when high stresses are reached or when there is a wide variation in the load between two observations.

Of the material contributed by Sooysmith & Co., the silica-Portland cement concrete cubes were made between the dates November 14 and 27, 1895.

The three individual cubes were tested June 7, 1897, and the column composed of nine cubes on July 6, 1897.

The composition of these twelve cubes was: Silica-Portland cement, 1 part; coarse clean grit sand from Port Eaton, L. I., 2 parts, and quartz gravel from Port Eaton, L. I., 3 parts. The gravel ran from one-half inch to 2 inches diameter.

The cubes of Alsen's cement concrete were made as follows:

A11, 1 and 2 on March 15, 1897.

A12, 1 and 2, respectively, on March 19 and 20, 1897.

The tests were made—

A11, 1—April 16, 1897.

A11, 2—April 17, 1897.

A12, 1—April 19, 1897.

A12, 2—April 20, 1897.

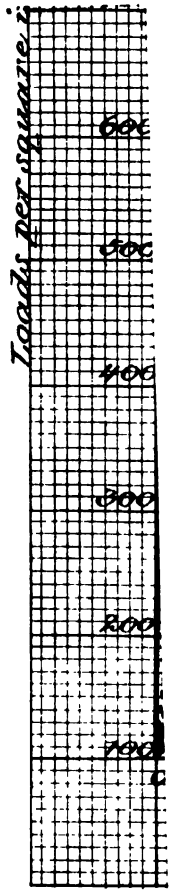
A12, 3 and 4—June 7, 1897.

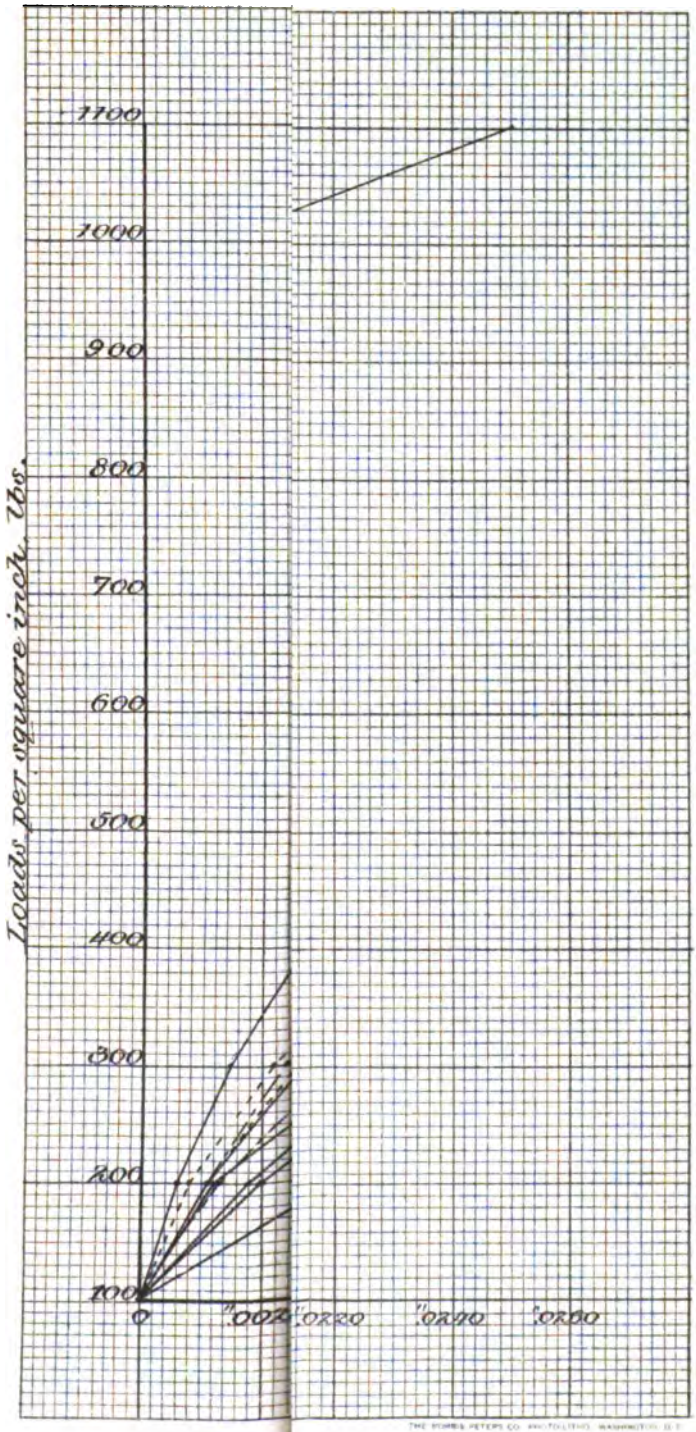
The composition of A11, 1 and 2, was: Alsen's cement, 1 part; washed Cow Bay sand, 2½ parts; crushed stone, limestone from the Hudson River Stone Company, 5 parts.

A12, 1 and 2: Alsen's cement, 1 part; washed Cow Bay sand, 3 parts; Tompkins Cove broken limestone, 6 parts.

The behavior of the silica-Portland cement concrete column was similar to the columns hereinbefore referred to in respect to the increased compression and resilience under higher loads.

1




1100
1000
900
800
700
600
500
400
300
200
100
0
.002"
.0110"
.0220"
.0330"
Loads per square inch. Lbs.

CONCRETE COLUMNS.

MEAN COMPRESSION AND MODULI OF ELASTICITY.

Applied loads per square inch.	Hand-mixed concrete.	Machine-mixed concrete.			
	Mean compression.	Mean compression.	Mean resilience.	Successive difference in mean resilience.	Modulus of elasticity per square inch.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Pounds.*
100	0.	0.	0.	0.	
200	.0014	.0015	.0010	.0010	5,000,000
300	.0031	.0031	.0022	.0012	4,167,000
400	.0051	.0050	.0036	.0014	3,571,000
500	.0076	.0070	.0051	.0015	3,333,000
600	.0106	.0095	.0068	.0017	2,941,000
700	.0140	.0122	.0086	.0018	2,778,000
800	.0195	.0156	.0108	.0022	2,273,000

Between loads per square inch of—	Modulus of elasticity per square inch.					
	Hand-mixed concrete.			Machine-mixed concrete.		
	Maximum.	Minimum.	Mean.	Maximum.	Minimum.	Mean.
Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
100 and 500	No. 8767 4,255,000	No. 8763 2,703,000	3,279,000	No. 8939 4,878,000	No. 8948 3,125,000	3,921,000
500 and 800	No. 8768 2,586,000	No. 8763 1,765,000	2,083,000	No. 8934 3,571,000	No. 8948 2,113,000	2,632,000

COMPRESSION OF CONCRETE COLUMNS

FROM

ABERTHAW CONSTRUCTION COMPANY, BOSTON, MASS.

HAND-MIXED CONCRETE.

Composition 1:3:6, consisting of a mixture made of 1 barrel Alsen cement, 3 barrels sand, and 6 barrels broken stone, of which 4 barrels were of 1¼″ ring stone and 2 barrels ½″ ring stone.

The columns were made and set in a cold storehouse unprovided with artificial heat. They were made December 3 and 4, 1896.

Columns tested in horizontal positions.

No. 8776.

Two-foot column.
Forty-seven days old.
Heiglft, 24″.23.
Weight, 294 pounds = 145 pounds per cubic foot. Not counter-weighted.
Cross-section dimensions, 12″.03 by 12″.02.
Sectional area, 144.6 square inches.
Ultimate strength, 154,950 pounds = 1,072 pounds per square inch.
Opened cracks 6″ from the lower end of the column in the vicinity of a porous place in the concrete.

No. 8777.

Two-foot column.
Forty-seven days old.
Height, 24″.20.
Weight, 294 pounds = 145 pounds per cubic foot. Not counter-weighted.
Cross-section dimensions, 12″.02 by 12″.04.
Sectional area, 144.7 square inches.
Ultimate strength, 132,680 pounds = 917 pounds per square inch.
Opened cracks 8″ from the lower end of the column.

No. 8774.

Four-foot column.
Forty-seven days old.
Height, 48″.25.
Weight, 582 pounds = 144 pounds per cubic foot. Not counter-weighted.
Cross-section dimensions, 12″.02 by 12″.04.
Sectional area, 144.7 square inches.
Ultimate strength, 154,400 pounds = 1,067 pounds per square inch.
Opened cracks 18″ from lower end.

No. 8775.

Four-foot column.
Forty-seven days old.
Height, 48″.30.
Weight, 580 pounds=144 pounds per cubic foot. Not counter-weighted.
Cross-section dimensions, 12″.02 by 12″.02.
Sectional area, 144.5 square inches.
Ultimate strength, 163,580 pounds = 1,132 pounds per square inch.
Opened cracks in the vicinity of the upper end of the column.

No. 8772.

Six-foot column.
Forty-six days old.
Height, 72″.08.
Counterweight at middle, 460 pounds.
Cross-section dimensions, 12″.02 by 12″.04.
Sectional area, 144.7 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,470	100	0.	0.	Initial load.
28,940	200	.0013	.....	
43,410	300	.0031	.....	
57,880	400	.0052	.....	
72,350	500	.0081	.....	
14,470	100	.....	.0013	
72,350	500	.0082	.....	
86,820	600	.0115	.....	
101,290	700	.0165	.....	
115,760	800	.0268	.....	
14,470	100	.....	.0117	
122,100	844	.....	.....	Ultimate strength.

Opened cracks at lower end of column, from the end extending 15″ along its length.

No. 8773.

Six-foot column.
Forty-six days old.
Height, 72″.30.
Weight, 870 pounds=143 pounds per cubic foot.
Counterweight at middle, 460 pounds.
Cross-section dimensions, 12″.06 by 12″.04.
Sectional area, 145.2 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,520	100	0.	0.	Initial load.
29,040	200	.0016	.....	
43,560	300	.0034	.....	
58,080	400	.0055	.....	
72,600	500	.0081	.....	
14,520	100	.....	.0016	
72,600	500	.0084	.....	
87,120	600	.0111	.....	
101,640	700	.0149	.....	
116,160	800	.0202	.....	
14,520	100	.....	.0061	
152,200	1,048	.....	.....	Ultimate strength.

Opened cracks near the middle of height of column.

No. 8767.

Eight-foot column.
Forty-two days old.
Height, 96″.35.
Weight, 1,177 pounds = 145 pounds per cubic foot.
Counterweight at middle, 460 pounds.
Cross-section dimensions, 12″.02 by 12″.08.
Sectional area, 145.2 square inches.
Gauged length, 50″

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,520	100	0.	0.	Initial load.
29,040	200	.0010	.....	
43,560	300	.0022	.....	
58,080	400	.0036	.....	
72,600	500	.0053	.....	
14,520	100	.....	.0006	
72,600	500	.0054	.....	
87,120	600	.0072	.....	
101,640	700	.0097	.....	
116,160	800	.0142	.....	
14,520	100	.....	.0033	
116,160	800	.0149	.....	
14,520	100	.....	.0037	
116,160	800	.0154	.....	
130,680	900	.0178	.....	
.....	900	.0184	.....	After 1 minute.
14,520	100	.....	.0051	
.....	.....	.....	.....	
135,700	935	.....	.....	Ultimate strength.

Opened cracks from 5″ to 20″ from the upper end of the column.

No. 8768.

Eight-foot column.
Forty-two days old.
Height, 96″.36.
Weight, 1,176 pounds = 145 pounds per cubic foot.
Counterweight at middle, 460 pounds.
Cross-section dimensions, 12″.02 by 12″.10.
Sectional area, 145.4 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,540	100	0.	0.	Initial load.
29,080	200	.0014	.....	
43,620	300	.0031	.....	
58,160	400	.0049	.....	
72,700	500	.0069	.....	
14,540	100	.....	.0010	
72,700	500	.0069	.....	
87,240	600	.0089	.....	
101,780	700	.0112	.....	
116,320	800	.0141	.....	
14,540	100	.....	.0024	
116,320	800	.0145	.....	
130,860	900	.0165	.....	Ultimate strength.
14,540	100	.....	.0030	

Opened cracks at a distance of 8″ to 18″ from the upper end of the column.

No. 8765.

Ten-foot column.
Forty days old.
Height, 120″.52.
Weight, 1,435 pounds = 142 pounds per cubic foot.
Counterweight at middle, 625 pounds.
Cross-section dimensions, 12″.04 by 12″.05.
Sectional area, 145 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,500	100	0.	0.	Initial load.
29,000	200	.0018	.....	
43,500	300	.0038	.....	
58,000	400	.0064	.....	
72,500	500	.0093	.....	
14,500	100	.....	.0024	
72,500	500	.0097	.....	
87,000	600	.0126	.....	
101,500	700	.0161	.....	
116,000	800	.0211	.....	
14,500	100	.....	.0070	
116,000	800	.0223	.....	
14,500	100	.....	.0079	
131,800	909	.....	.....	Ultimate strength.

Opened cracks at bottom end of column from the end along 2 feet.

No. 8766.

Ten-foot column.
Forty-one days old.
Height, 120″.53.
Weight, 1,443 pounds = 143 pounds per cubic foot.
Counterweight at middle, 625 pounds.
Cross-section dimensions, 12″.03 by 12″.04.
Sectional area, 144.8 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,480	100	0.	0.	Initial load.
28,960	200	.0012		
43,440	300	.0026		
57,920	400	.0045		
72,400	500	.0069		
14,480	100		.0007	
72,400	500	.0069		
	500	.0071		After 5 minutes.
	500	.0071		After 10 minutes.
	500	.0071		After 15 minutes.
86,880	600	.0086		
101,360	700	.0124		
	700	.0141		After 5 minutes.
115,840	800	.0170		
	800	.0186		Do.
14,480	100		.0050	
72,400	500	.0128		
	500	.0129		After 2 minutes.
72,400	500			Load left on column overnight, 16 hours.
71,500				Load found on column in the morning.
72,400	500	.0121		
14,480	100		.0050	
72,400	500	.0120		
14,480	100		.0050	
72,400	500	.0119		
86,880	600	.0137		
101,360	700	.0159		
115,840	800	.0188		
14,480	100		.0054	
116,800	807			Ultimate strength.

Opened cracks from bottom end along 12″ of column.

No. 8763.

Twelve-foot column.
Thirty-nine days old.
Height, 144″.61.
Weight, 1,749 pounds=144 pounds per cubic foot.
Counterweight at middle, 760 pounds.
Cross-section dimensions, 12″.03 by 12″.05.
Sectional area, 144.9 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,490	100	0.	0.	Initial load.
28,980	200	.0017	.....	
43,470	300	.0037	.....	
57,960	400	.0065	.....	
72,450	500	.0102	.....	
14,490	100	.....	.0028	
72,450	500	.0106	.....	
14,490	100	.....	.0032	
72,450	500	.0108	.....	
.....	500	.0112	.....	After 1 minute.
.....	500	.0116	.....	After 5 minutes.
.....	500	.0120	.....	After 10 minutes.
.....	500	.0122	.....	After 15 minutes.
.....	500	.0125	.....	After 20 minutes.
.....	500	.0126	.....	After 25 minutes.
.....	500	.0127	.....	After 30 minutes.
14,490	100	.....	.0052	
72,450	500	.0127	.....	
.....	500	.0131	.....	After 5 minutes.
.....	500	.0132	.....	After 10 minutes.
86,940	600	.0156	.....	
101,430	700	.0191	.....	
.....	700	.0215	.....	After 2 minutes.
.....	700	.0225	.....	After 5 minutes.
.....	700	.0232	.....	After 10 minutes.
115,920	800	.0265	.....	
.....	800	.0285	.....	After 2 minutes.
.....	800	.0299	.....	After 5 minutes.
14,490	100	.....	.0140	
.....	100	.....	.0136	After 2 minutes.
.....	100	.....	.0134	After 5 minutes.
115,920	800	.0310	.....	
14,490	100	.....	.0147	
137,300	947	.....	.....	Ultimate strength.

Opened oblique cracks from 5″ to 30″ from the bottom of the column.

No. 8764.

Twelve-foot column.
Thirty-nine days old.
Height, 144″.87.
Weight, 1,753 pounds=144 pounds per cubic foot.
Counterweight at middle, 760 pounds.
Cross-section dimensions, 12″.04 by 12″.05.
Sectional area, 145 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,500	100	0.	0.	Initial load.
29,000	200	.0007	.....	
43,500	300	.0018	.....	
58,000	400	.0036	.....	
72,500	500	.0056	.....	
14,500	100	.....	.0005	
72,500	500	.0058	.....	
87,000	600	.0081	.....	
101,500	700	.0117	.....	
116,000	800	.0167	.....	
14,500	100	.....	.0041	
116,000	800	.0179	.....	
14,500	100	.....	.0051	
29,000	200	.0063	.....	
43,500	300	.0082	.....	
58,000	400	.0102	.....	
72,500	500	.0122	.....	
58,000	400	.0107	.....	
43,500	300	.0090	.....	
29,000	200	.0071	.....	
14,500	100	.....	.0051	
130,500	900	.0257	.....	
14,500	100	.....	.0093	
142,100	980	.....	.....	Ultimate strength.

Opened oblique cracks at upper end of the column from the top extending downward 2 feet.

No. 8759.

Fourteen-foot column.
Thirty-four days old.
Height, 168″.70.
Weight, 2,052 pounds=145 pounds per cubic foot.
Counterweight at middle, 760 pounds.
Cross-section dimensions, 12″.01 by 12″.03.
Sectional area, 144.5 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,450	100	0.	0.	Initial load.
28,900	200	.0020	.....	
43,350	300	.0040	.....	
57,800	400	.0062	.....	
72,250	500	.0088	.....	
14,450	100	.....	.0032	
72,250	500	.0095	.....	
86,700	600	.0123	.....	
.....	600	.0129	.....	After 1 minute.
101,150	700	.0163	.....	
.....	700	.0170	.....	Do.
115,600	800	.0208	.....	
.....	800	.0218	.....	Do.
14,450	100	.....	.0092	
.....	100	.....	.0088	After 3 minutes.
115,600	800	.0225	.....	
14,450	100	.....	.0098	
135,300	936	.....	.....	Ultimate strength.

Opened oblique cracks from 10″ to 30″ from upper end of the column.

No. 8760.

Fourteen-foot column.
Thirty-five days old.
Height, 168″.76.
Weight, 2,061 pounds = 145 pounds per cubic foot.
Counterweight at middle, 760 pounds.
Cross-section dimensions, 12″.03 by 12″.07.
Sectional area, 145.2 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,520	100	0.	0.	Initial load.
29,040	200	.0016	.....	
43,560	300	.0032	.....	
58,080	400	.0051	.....	
72,600	500	.0072	.....	
14,520	100	.....	.0012	
72,600	500	.0073	.....	
.....	500	.0076	.....	After 5 minutes.
87,120	600	.0097	.....	
.....	600	.0101	.....	After 1 minute.
101,640	700	.0125	.....	
.....	700	.0130	.....	Do.
116,160	800	.0157	.....	
.....	800	.0173	.....	Do.
14,520	100	.....	.0049	
116,160	800	.0179	.....	
14,520	100	.....	.0052	
131,750	907	.....	.....	Ultimate strength.

Opened oblique cracks at a distance from 10″ to 30″ from the upper end of the column.

MACHINE-MIXED CONCRETE.

The method of mixing was as follows:

A rotary drum mixer was used, making about ten revolutions per minute. The proper amount of water was first put into the machine; the stone was put in next, followed by the sand, and the cement last.

None of the concrete was mixed for a less period than five minutes, the average length of time being a little more than ten minutes.

No. 8952.

Two-foot column. Forty-seven days old.
Composition, 1:3:6=1 cement, 3 gravel, 4–1¼″ stone, 2–⅜″ stone.
Height, 24″.74.
Weight, 300 pounds = 144.5 pounds per cubic foot. Not counterweighted.
Cross-section dimensions, 12″.06 by 12″.02. Sectional area, 145 square inches.
Ultimate strength, 171,800 pounds = 1,185 pounds per square inch.
Failed by opening cracks entire length of column.

No. 8953.

Two-foot column.
Forty-seven days old.
Composition, 1:3:6=1 cement, 3 gravel, 4–1¼″ stone, 2–⅜″ stone.
Height, 24″.27.
Weight, 298 pounds=146.5 pounds per cubic foot. Not counterweighted.
Cross-section dimensions, 12″.04 by 12″.03.
Sectional area, 144.8 square inches.
Ultimate strength, 171,400 pounds=1,183 pounds per square inch.
Failed by opening cracks along its length.

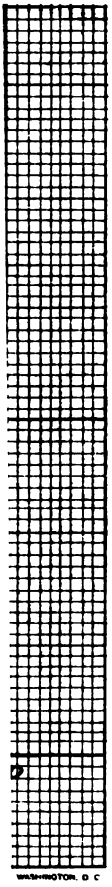
No. 8950.

Four-foot column.
Forty-eight days old.
Composition, 1:3:6 = 1 cement, 3 gravel, 4–1¼″ stone, 2–⅜″ stone.
Height, 48″.52.
Weight, 583 pounds=143.2 pounds per cubic foot. Not counterweighted.
Cross-section dimensions, 12″.05 by 12″.03.
Sectional area, 145 square inches.
Ultimate strength, 142,100 pounds = 980 pounds per square inch.
Failed by opening oblique cracks along the lower half of column.

No. 8951.

Four-foot column.
Forty-eight days old.
Composition, 1:3:6=1 cement, 3 gravel, 4–1¼″ stone, 2–⅜″ stone.
Height, 48″.58.
Weight, 584 pounds = 143.6 pounds per cubic foot. Not counterweighted.
Cross-section dimensions, 12″.04 by 12″.02.
Sectional area, 144.7 square inches.
Ultimate strength, 135,400 pounds = 936 pounds per square inch.
Failed by opening cracks near the middle of its length.

3



No. 8948.

Six-foot column.
Forty-eight days old.
Composition, 1:3:6 = 1 cement, 3 gravel, 4–1¼″ stone, 2–⅜″ stone.
Height, 72″.35.
Weight, 894 pounds = 146.2 pounds per cubic foot.
Counterweight at middle, 460 pounds.
Cross-section dimensions, 12″.10 by 12″.07.
Sectional area, 146 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,600	100	0.	0.	Initial load.
29,200	200	.0029	.....	
14,600	100	.....	.0018	
43,800	300	.0062	.....	
14,600	100	.....	.0035	
58,400	400	.0095	.....	
14,600	100	.....	.0050	
73,000	500	.0129	.....	
14,600	100	.....	.0065	
87,600	600	.0171	.....	
14,600	100	.....	.0086	
102,200	700	.0214	.....	
14,600	100	.....	.0104	
116,800	800	.0271	.....	
14,600	100	.....	.0136	
131,400	900	.0341	.....	
14,600	100	.....	.0178	
146,000	1,000	.0440	.....	
14,600	100	.....	.0241	
160,600	1,100	.0640	.....	
14,600	100	.....	.0390	
165,200	1,131	.0980	.....	Ultimate strength.

Failed by opening cracks near the middle of its length.

No. 8949.

Six-foot column.
Forty-eight days old.
Composition, 1:3:6 = 1 cement, 3 gravel, 4–1¼″ stone, 2–⅜″ stone.
Height, 72″.24.
Weight, 890 pounds = 146 pounds per cubic foot.
Counterweight at middle, 460 pounds.
Cross-section dimensions, 12″.06 by 12″.09.
Sectional area, 145.8 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,580	100	0.	0.	Initial load.
29,160	200	.0025	.....	
14,580	100	.....	.0019	
43,740	300	.0049	.....	
14,580	100	.....	.0034	
58,320	400	.0075	.....	
14,580	100	.....	.0048	
72,900	500	.0098	.....	
14,580	100	.....	.0056	
87,480	600	.0129	.....	
14,580	100	.....	.0066	
102,060	700	.0161	.....	
14,580	100	.....	.0080	
116,640	800	.0205	.....	
14,580	100	.....	.0093	
131,220	900	.0253	.....	
14,580	100	.....	.0116	
145,800	1,000	.0335	.....	
14,580	100	.....	.0160	
160,380	1,100	.0428	.....	
14,580	100	.....	.0218	
174,960	1,200	.0765	.....	Ultimate strength.

Failed by opening cracks 18″ from the top end.

No. 8938.

Eight-foot column.
Forty-two days old.
Composition, 1:3:6 = 1 cement, 3 gravel, 4–1¼″ stone, 2–⅜″ stone.
Height, 96″.17.
Weight, 1,187 pounds = 145.6 pounds per cubic foot.
Counterweight at middle, 460 pounds.
Cross-section dimensions, 12″.05 by 12″.16.
Sectional area, 146.5 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,650	100	0.	0.	
29,300	200	.0011	.....	Initial load.
14,650	100	.....	.0003	
43,950	300	.0026	.....	
14,650	100	.....	.0008	
58,600	400	.0049	.....	
14,650	100	.....	.0013	
73,250	500	.0072	.....	
14,650	100	.....	.0020	
87,900	600	.0102	.....	
14,650	100	.....	.0030	
102,550	700	.0136	.....	
14,650	100	.....	.0042	
117,200	800	.0179	.....	
14,650	100	.....	.0062	
131,850	900	.0236	.....	
14,650	100	.....	.0093	
146,500	1,000	.0305	.....	
14,650	100	.....	.0134	
161,150	1,100	.0395	.....	
14,650	100	.....	.0195	
162,400	1,108	.....	.....	Ultimate strength.

Failed by opening cracks 22″ from the bottom end of the column.

No. 8939.

Eight-foot column.
Forty-two days old.
Composition, 1:3:6 = 1 cement, 3 gravel, 4–1¼″ stone, 2–¾″ stone.
Height, 96″.20.
Weight, 1,193 pounds = 146.1 pounds per cubic foot.
Counterweight at middle, 460 pounds.
Cross-section dimensions, 12″.18 by 12″.04.
Section of area, 146.6 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,660	100	0.	0.	Initial load.
29,320	200	.0006	.....	
14,660	100	.....	0.	
43,980	300	.0016	.....	
14,660	100	.....	0.	
58,640	400	.0028	.....	
14,660	100	.....	.0001	
73,300	500	.0044	.....	
14,660	100	.....	.0003	
87,960	600	.0066	.....	
14,660	100	.....	.0007	
102,620	700	.0092	.....	
14,660	100	.....	.0014	
117,280	800	.0126	.....	
14,660	100	.....	.0025	
131,940	900	.0170	.....	
14,660	100	.....	.0043	
146,600	1,000	.0227	.....	
14,660	100	.....	.0071	
159,200	1,086	.....	.....	Ultimate strength.

Failed by opening cracks at the bottom end of the column.

No. 8936.

Ten-foot column.
Forty-one days old.
Composition, 1:3:6 = 1 cement, 3 gravel, 4–1¼″ stone, 2–⅜″ stone.
Height, 120″.30.
Weight, 1,484 pounds, = 146 pounds per cubic foot.
Counterweight at middle, 625 pounds.
Cross-section dimensions, 12″.05 by 12″.12.
Sectional area, 146 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,600	100	0.	0.	
29,200	200	.0019	.....	Inital load
14,600	100	.....	.0005	
43,800	300	.0040	.....	
14,600	100	.....	.0011	
58,400	400	.0065	.....	
14,600	100	.....	.0019	
73,000	500	.0090	.....	
14,600	100	.....	.0026	
87,600	600	.0119	.....	
14,600	100	.....	.0035	
102,200	700	.0153	.....	
14,600	100	.....	.0050	
116,800	800	.0187	.....	
14,600	100	.....	.0064	
131,400	900	.0224	.....	
14,600	100	.....	.0080	
146,000	1,000	.0271	.....	
14,600	100	.....	.0105	
148,200	1,015	.....	.....	Ultimate strength.

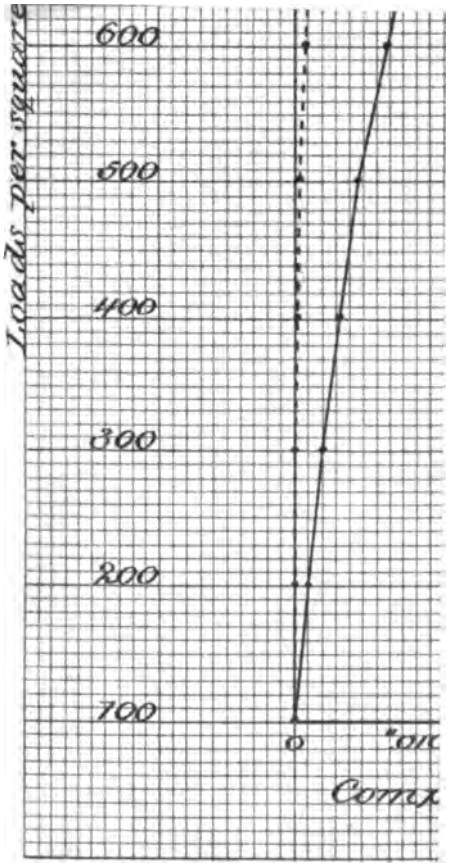
Failed by opening cracks 18″ from the lower end of column.

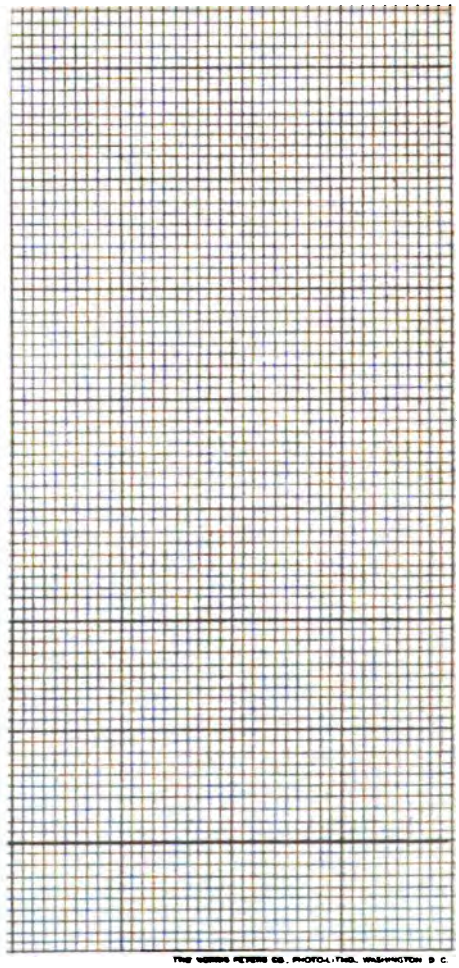
No. 8937.

Ten-foot column.
Forty-two days old.
Composition, 1 : 3 : 6=1 cement, 3 gravel, 4–1¼″ stone, 2–⅜″ stone.
Height, 120″.36.
Weight, 1,487 pounds=146.2 pounds per cubic foot.
Counterweight at middle, 625 pounds.
Cross-section dimensions, 12″.09 by 12″.08.
Sectional area, 146 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,600	100	0.	0.	Initial load.
29,200	200	.0010	.....	
14,600	100	.....	.0000	
43,800	300	.0020	.....	
14,600	100	.....	.0000	
58,400	400	.0032	.....	
14,600	100	.....	.0001	
73,000	500	.0046	.....	
14,600	100	.....	.0003	
87,600	600	.0067	.....	
14,600	100	.....	.0008	
102,200	700	.0086	.....	
14,600	100	.....	.0011	
116,800	800	.0111	.....	
14,600	100	.....	.0018	
131,400	900	.0141	.....	
14,600	100	.....	.0029	
146,000	1,000	.0186	.....	Ultimate strength.
14,600	100	.....	.0049	

Failed by opening cracks near the bottom end of column.


Loads per square
600
500
400
300
200
100
0
Comp.



No. 8934.

Twelve-foot column.
Thirty-seven days old.
Composition, 1:3:6=1 cement, 3 gravel, 4–1¼″ stone, 2–⅜″ stone.
Height, 144″.29.
Weight, 1,814 pounds=148.8 pounds per cubic foot.
Counterweight at middle, 760 pounds.
Cross-section dimensions, 12″.10 by 12″.07.
Sectional area, 146 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,600	100	0.	0.	Initial load.
29,200	200	.0011	.....	
14,600	100	.....	0.	
43,800	300	.0022	.....	
14,600	100	.....	0.	
58,400	400	.0033	.....	
14,600	100	.....	− .0003	
73,000	500	.0045	.....	
14,600	100	.....	− .0003	
87,600	600	.0060	.....	
14,600	100	.....	− .0001	
102,200	700	.0077	.....	
14,600	100	.....	+ .0001	
116,800	800	.0092	.....	
14,600	100	.....	.0002	
131,400	900	.0115	.....	
14,600	100	.....	.0007	
146,000	1,000	.0140	.....	
14,600	100	.....	.0015	
160,600	1,100	.0171	.....	
14,600	100	.....	.0025	
175,200	1,200	.0215	.....	
14,600	100	.....	.0041	
189,800	1,300	.0260	.....	
14,600	100	.....	.0061	
204,400	1,400	.....	.....	Ultimate strength.

Failed by opening cracks along 30″ at upper end of column, finally separating with an oblique fracture making an angle of about 35 degrees with axis of column.

No. 8935.

Twelve-foot column.
Thirty-nine days old.
Composition, 1:3:6. = 1 cement, 3 gravel, 4–1¼″ stone, 2–⅜″ stone.
Height, 144″.40.
Weight, 1,800 pounds = 148.2 pounds per cubic foot.
Counterweight at middle, 760 pounds.
Cross-section dimensions, 12″.07 by 12″.04.
Sectional area, 145.3 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14, 530	100	0.	0.	Initial load.
29, 060	200	.0013	.....	
14, 530	100	.....	0.	
43, 590	300	.0029	.....	
14, 530	100	.....	.0004	
58, 120	400	.0049	.....	
14, 530	100	.....	.0008	
72, 650	500	.0069	.....	
14, 530	100	.....	.0012	
87, 180	600	.0090	.....	
14, 530	100	.....	.0017	
101, 710	700	.0114	.....	
14, 530	100	.....	.0023	
116, 240	800	.0144	.....	
14, 530	100	.....	.0034	
130, 770	900	.0171	.....	
14, 530	100	.....	.0044	
145, 300	1, 000	.0209	.....	
14, 530	100	.....	.0058	
159, 830	1, 100	.0246	.....	
14, 530	100	.....	.0074	
174, 360	1, 200	.0301	.....	
14, 530	100	.....	.0104	
188, 890	1, 300	.0361	.....	
14, 530	100	.....	.0135	
203, 420	1, 400	.0428	.....	
14, 530	100	.....	.0174	
217, 950	1, 500	.0635	.....	
14, 530	100	.....	.0315	
218, 000	1, 500+	.0789	.....	Ultimate strength.

Failed at the upper end of the column. Opened oblique cracks along 30″ of length.

No. 8930.

Fourteen-foot column.
Thirty-five days old.
Composition, 1:3:6.=1 cement, 3 gravel, 4–1¼″ stone, 2–⅜″ stone.
Height, 168″.27.
Weight, 2,107 pounds=148.4 pounds per cubic foot.
Counterweight at middle, 760 pounds.
Cross-section dimensions, 12″.06 by 12″.09.
Sectional area, 145.8 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14, 580	100	0.	0.	Initial load.
29, 160	200	.0010	.....	
14, 580	100	.....	0.	
43, 740	300	.0022	.....	
14, 580	100	.....	0.	
58, 320	400	.0035	.....	
14, 580	100	.....	.0001	
72, 900	500	.0053	.....	
14, 580	100	.....	.0004	
72, 900	500	.0054	.....	
87, 480	600	.0072	.....	
14, 580	100	.....	.0009	
29, 160	200	.0019	.....	
43, 740	300	.0032	.....	
58, 320	400	.0043	.....	
72, 900	500	.0056	.....	
87, 480	600	.0073	.....	
102, 060	700	.0094	.....	
14, 580	100	.....	.0015	
116, 640	800	.0123	.....	
14, 580	100	.....	.0024	
125, 100	858	.....	.....	Ultimate strength.

Failed by developing cracks at the lower end, the cracks extending along the column a distance of 2 feet.

No. 8931.

Fourteen-foot column.
Thirty-five days old.
Composition, 1:3:6=1 cement, 3 gravel, 4–1¼″ stone, 2–⅜″ stone.
Height, 168″.62.
Weight, 2,112 pounds=147.8 pounds per cubic foot.
Counterweight at middle, 760 pounds.
Cross-section dimensions, 12″.05 by 12″.15.
Sectional area, 146.4 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,640	100	0.	0.	Initial load.
29,280	200	.0012	.....	
14,640	100	.....	.0002	
43,920	300	.0025	.....	
14,640	100	.....	.0004	
58,560	400	.0040	.....	
14,640	100	.....	.0006	
73,200	500	.0055	.....	
14,640	100	.....	.0009	
87,840	600	.0075	.....	
14,640	100	.....	.0014	
102,480	700	.0095	.....	
14,640	100	.....	.0019	
117,120	800	.0122	.....	
14,640	100	.....	.0025	
118,200	807	.....	.....	Ultimate strength.

Failed by opening cracks between 6″ and 24″ of the lower end.

No. 8940.

Six-foot column.
Forty-two days old.
Composition, 1 : 6 : 12 =1 cement, 6 gravel, 8–1¼″ stone, 4–⅜″ stone.
Height, 72″.48.
Weight, 869 pounds =142.6 pounds per cubic foot.
Counterweight at middle, 460 pounds.
Cross-section dimensions, 12″.05 by 12″.06.
Sectional area, 145.3 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,530	100	0.	0.	Initial load.
29,060	200	.0030	.....	
14,530	100	.....	.0012	
43,590	300	.0085	.....	
14,530	100	.....	.0045	
58,120	400	.0251	.....	
14,530	100	.....	.0175	
72,650	500	.0840	.....	Ultimate strength.

Failed by opening cracks 15″ from the bottom end of column.

No. 8941.

Six-foot column.
Forty-two days old.
Composition, 1:6:12=1 cement, 6 gravel, 8–1¼″ stone, 4–⅜″ stone.
Height, 72″.50.
Weight, 870 pounds=143.5 pounds per cubic foot.
Counterweight at middle, 460 pounds.
Cross section dimensions, 12″.04 by 12″.00.
Sectional area, 144.5 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,450	100	0.	0.	Initial load.
28,900	200	.0039	.....	
14,450	100	.....	.0019	
43,350	300	.0094	.....	
14,450	100	.....	.0049	
57,800	400	.0235	.....	
14,450	100	.....	.0155	
67,600	467	.1375	.....	Ultimate strength.

Failed by opening cracks 18″ from the bottom end of column.

No. 8942.

Six-foot column.
Forty-two days old.
Composition 1:7:13 =1 cement, 7 gravel, 8⅜–1¼″ stone, 4⅛–⅜″ stone.
Height, 72″.44.
Weight, 862 pounds=140.8 pounds per cubic foot.
Counterweight at middle, 460 pounds.
Cross-section dimensions, 12″.05 by 12″.12.
Sectional area, 146 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,600	100	0.	0.	Initial load.
29,200	200	.0056	.....	
14,600	100	.....	.0044	
43,800	300	.0150	.....	
14,600	100	.....	.0112	
58,400	400	.0445	.....	
14,600	100	.....	.0369	
62,400	427	.1344	.....	Ultimate strength.

Failed by general cracks, developed along middle half of its length.

No. 8943.

Six-foot column.
Forty-two days old.
Composition, 1:7:13 = 1 cement, 7 gravel, $8\frac{3}{4}$–$1\frac{1}{2}$″ stone, $4\frac{1}{8}$–$\frac{3}{8}$″ stone.
Height, 72″.47.
Weight, 866 pounds = 141.9 pounds per cubic foot.
Counterweight at middle, 460 pounds.
Cross-section dimensions, 12″.06 by 12″.07.
Sectional area, 145.5 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,550	100	0	0.	Initial load.
29,100	200	.0109	.....	
14,550	100	.....	.0077	
43,650	300	.0284	.....	
14,550	100	.....	.0215	
58,200	400	.0730	.....	
14,550	100	.....	.0608	
63,400	436	.1400	.....	Ultimate strength.

Failed by opening cracks 12″ to 24″ from the upper end of the column.

No. 8944.

Six-foot column.
Forty-five days old.
Composition, 1:5:10 = 1 cement, 5 gravel, $6\frac{2}{3}$–$1\frac{1}{4}$″ stone, $3\frac{1}{3}$–$\frac{3}{8}$″ stone.
Height, 72″.45.
Weight, 887 pounds = 145.9 pounds per cubic foot.
Counterweight at middle, 460 pounds.
Cross-section dimensions, 12″.05 by 12″.04.
Sectional area, 145 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,500	100	0.	0.	Initial load.
29,000	200	.0008	.....	
14,500	100	.....	0.	
43,500	300	.0022	.....	
14,500	100	.....	.0000	
58,000	400	.0045	.....	
14,500	100	.....	.0003	
72,500	500	.0087	.....	
14,500	100	.....	.0006	
87,000	600	.0176	.....	
14,500	100	.....	.0065	
102,600	708	.0950	.....	Ultimate strength.

Failed by opening cracks 1 foot from the middle of its length.

No. 8945.

Six-foot column.
Forty-five days old.
Composition, 1:5:10=1 cement, 5 gravel, $6\frac{2}{3}$–$1\frac{1}{4}$″ stone, $3\frac{1}{3}$–$\frac{3}{8}$″ stone.
Height, 72″.42.
Weight, 893 pounds=145.5 pounds per cubic foot.
Counterweight at middle, 460 pounds.
Cross-section dimensions, 12″.13 by 12″.07.
Sectional area, 146.4 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,640	100	0.	0.	Initial load.
29,280	200	.0013	.....	
14,640	100	.....	.0002	
43,920	300	.0034	.....	
14,640	100	.....	.0008	
58,560	400	.0064	.....	
14,640	100	.....	.0018	
73,200	500	.0110	.....	
14,640	100	.....	.0039	
87,840	600	.0200	.....	
14,640	100	.....	.0093	
102,480	700	.0393	.....	
14,640	100	.....	.0240	
109,300	747	.0752	.....	Ultimate strength.

Failed by opening cracks along middle part of its length.

No. 8946.

Six-foot column.
Forty-six days old.
Composition, 1:4:8 = 1 cement, 4 gravel, $5\frac{1}{3}$–$1\frac{1}{4}$″ stone, $2\frac{2}{3}$–$\frac{3}{8}$″ stone.
Height, 72″.30.
Weight, 885 pounds = 145.7 pounds per cubic foot.
Counterweight at middle, 460 pounds.
Cross-section dimensions, 12″.06 by 12″.04.
Sectional area, 145.2 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,520	100	0.	0.	Initial load.
29,040	200	.0012	.....	
14,520	100	.....	0.	
43,560	300	.0021	.....	
14,520	100	.....	−.0003	
58,080	400	.0037	.....	
14,520	100	.....	−.0004	
72,600	500	.0050	.....	
14,520	100	.....	−.0001	
87,120	600	.0098	.....	
14,520	100	.....	+.0010	
101,640	700	.0159	.....	
14,520	100	.....	.0037	
116,160	800	.0290	.....	
14,520	100	.....	.0119	
130,680	900	.1000	.....	Ultimate strength.

Failed by opening cracks along the middle of its length.

No. 8947.

Six-foot column.
Forty-six days old.
Composition, 1:4:8=1 cement, 4 gravel, $5\frac{1}{3}$–$1\frac{1}{4}$″ stone, $2\frac{2}{3}$–$\frac{3}{8}$″ stone.
Height, 72″.39.
Weight, 884 pounds=144.8 pounds per cubic foot.
Counterweight at middle, 460 pounds.
Cross-section dimensions, 12″.08 by 12″.06.
Sectional area, 145.7 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,570	100	0.	0.	Initial load.
29,140	200	.0018	.....	
14,570	100	.....	.0005	
43,710	300	.0046	.....	
14,570	100	.....	.0014	
58,280	400	.0080	.....	
14,570	100	.....	.0027	
72,850	500	.0129	.....	
14,570	100	.....	.0050	
87,420	600	.0194	.....	
14,570	100	.....	.0088	
101,990	700	.0326	.....	
14,570	100	.....	.0179	
116,200	797	.1030	.....	Ultimate strength.

Failed by opening cracks near the middle of its length.

No. 8932.

Twelve-foot column.
Thirty-six days old.
Composition, 1:3:6 = 1 cement, 3 gravel, 6–$\frac{3}{8}$″ stone. Strengthened with 4 bars $\frac{3}{4}$ inch square cold-twisted steel embedded in the concrete.
Height, 144″.37.
Weight, 1,818 pounds = 150.1 pounds per cubic foot.
Counterweight at middle, 760 pounds.
Cross section dimensions, 12″.04 by 12″.05.
Sectional area, 145 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,500	100	0.	0.	Initial load.
29,000	200	.0008	.....	
14,500	100	.....	0.	
43,500	300	.0020	.....	
14,500	100	.....	0.	
58,000	400	.0034	.....	
14,500	100	.....	.0001	
72,500	500	.0050	.....	
14,500	100	.....	.0004	
87,000	600	.0067	.....	
14,500	100	.....	.0008	
101,500	700	.0086	.....	
14,500	100	.....	.0010	
116,000	800	.0110	.....	
14,500	100	.....	.0016	
130,500	900	.0139	.....	
14,500	100	.....	.0023	
145,000	1,000	.0181	.....	
14,500	100	.....	.0040	
159,500	1,100	.0217	.....	Cracks at each end of column about 12″ long each.
14,500	100	.....	.0053	
174,000	1,200	.0259	.....	
14,500	100	.....	.0067	
181,300	1,250	.....	.....	Ultimate strength.

Failed by opening cracks within a section 18″ long at the upper end of column.

NOTE.—The twisted steel rodstook a bearing at the lower end of the column, but did not reach flush with the upper end, ending about $\frac{1}{2}$″ below the top surface.

No. 8933.

Twelve-foot column.
Thirty-nine days old.
Composition, 1:3:6 = 1 cement, 3 gravel, 6–¾″ stone. Strengthened with 4 bars ¾ inch square cold-twisted steel, embedded in the concrete.
Height, 144″.23.
Weight, 1,812 pounds = 149.4 pounds per cubic foot.
Counterweight at middle, 760 pounds.
Cross-section dimensions, 12″.04 by 12″.07.
Sectional area, 145.3 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,530	100	0.	0.	Initial load.
29,060	200	.0014	.....	
14,530	100	.....	0.	
43,590	300	.0029	.....	
14,530	100	.....	0.	
58,120	400	.0048	.....	
14,530	100	.....	.0015	
				Trestles supporting column removed.
58,120	400	.0056	.....	
14,530	100	.....	.0015	
29,060	200	.0028	.....	
43,590	300	.0042	.....	
58,120	400	.0057	.....	
72,650	500	.0076	.....	
14,530	100	.....	.0020	
87,180	600	.0100	.....	
14,530	100	.....	.0026	
101,710	700	.0120	.....	
14,530	100	.....	.0030	
116,240	800	.0146	.....	
14,530	100	.....	.0038	
130,770	900	.0178	.....	
14,530	100	.....	.0051	
145,300	1,000	.0214	.....	
14,530	100	.....	.0064	
159,830	1,100	.0249	.....	
14,530	100	.....	.0075	
174,360	1,200	.0293	.....	
14,530	100	.....	.0087	
188,890	1,300	.0355	.....	
14,530	100	.....	.0116	
203,420	1,400	.0417	.....	
14,530	100	.....	.0136	
216,400	1,489	.0512 .0544	.....	Cracks opened 20″ from lower end. Sustained this load 15 minutes, the compression increasing in the meantime to ″.0600
14,530	100	.....	.0194	
217,950	1,500	.0611	.....	
14,530	100	.....	.0219	
232,480	1,600	.0661	.....	
14,530	100	.....	.0223	
232,480	1,600	.0681	.....	
14,530	100	.....	.0225	
247,010	1,700	.0754	.....	Ultimate strength.
14,530	100	.....	.0284	

Failed 20″ from lower end of column. Open cracks in the concrete which were followed by buckling of the twisted steel bars.

Iron plates 2″ by 2″ by ½″ to ⅝″ thickness were used, one on the upper end of each twisted rod to level the top and bring the twisted rods to an initial bearing on the buttress of the testing machine.

TABULATION OF COMPRESSION TESTS OF 12" BY 12" CONCRETE COLUMNS MADE BY THE ABERTHAW CONSTRUCTION COMPANY, BOSTON, MASS.

COLUMNS MADE OF HAND-MIXED CONCRETE.

No. of test.	Nominal height.	Age when tested.	Composition.	Weight.		Dimensions.		Sectional area.	Ultimate strength.		Manner of failure.
				Total.	Per cubic foot.	Height.	Cross section.		Total.	Per square inch.	
	Feet.	*Days.*		*Pounds.*	*Pounds.*	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	
8776	2	47	1 cement, 3 sand, 4–1½" broken stone, 2–¾" broken stone.	294	145	24.23	12.03×12.02	144.6	154,950	1,072	Opened cracks 6" from the lower end of the column in the vicinity of a porous place in the concrete.
8777	2	47	.....do	294	145	24.20	12.02×12.04	144.7	132,680	917	Opened cracks 8" from the lower end of column.
8774	4	47	.....do	582	144	48.25	12.02×12.04	144.7	154,400	1,067	Opened cracks 18" from lower end of column.
8775	4	47	.....do	580	144	48.30	12.02×12.02	144.5	163,580	1,132	Opened cracks in the vicinity of the upper end of the column.
8772	6	46	.....do	.....	.....	72.08	12.02×12.04	144.7	122,100	844	Opened cracks at lower end of column, from the end extending 15" along its length.
8773	6	46	.....do	870	143	72.30	12.06×12.04	145.2	152,200	1,048	Opened cracks near the middle of height of column.
8767	8	42	.....do	1,177	145	96.35	12.02×12.08	145.2	135,700	935	Opened cracks from 5" to 20" from the upper end of the column.
8768	8	42	.....do	1,176	145	96.36	12.02×12.10	145.4	130,860	900	Opened cracks at a distance of 3" to 18" from the upper end of the column.
8765	10	40	.....do	1,435	142	120.52	12.04×12.05	145	131,800	909	Opened cracks at bottom end of column, from the end along 2 feet.
8766	10	41	.....do	1,443	143	120.53	12.03×12.04	144.8	116,800	807	Opened cracks from bottom end along 12" of column.
8763	12	39	.....do	1,749	144	144.61	12.03×12.05	144.9	137,300	947	Opened oblique cracks from 5" to 30" from the bottom of the column.
8764	12	39	.....do	1,753	144	144.87	12.04×12.05	145	142,100	980	Opened oblique cracks at upper end of the column, from the top extending downward 2 feet.
8759	14	34	.....do	2,052	145	168.70	12.01×12.03	144.5	135,300	936	Opened oblique cracks from 10" to 30" from upper end of column.
8760	14	35	.....do	2,061	145	168.76	12.03×12.07	145.2	131,750	907	Opened oblique cracks at a distance from 10" to 30" from the upper end of the column.

Tabulation of compression tests of 12″ by 12″ concrete columns—Continued.

COLUMNS MADE OF MACHINE-MIXED CONCRETE.

No. of test.	Nominal height.	Age when tested.	Composition.	Weight.		Dimensions.		Sectional area.	Ultimate strength.		Manner of failure.
				Total.	Per cubic foot.	Height.	Cross section.		Total.	Per square inch.	
	Feet.	*Days.*		*Pounds.*	*Pounds.*	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	
8952	2	47	1 cement, 3 gravel, 4 1½″ broken stone, 2 ⅜″ broken stone.	300	144.5	24.74	12.06×12.02	145	171,800	1,185	Opened cracks entire length of column.
8953	2	47	.....do.....	298	146.5	24.27	12.04×12.03	144.8	171,400	1,183	Opened cracks along its length.
8950	4	48	.....do.....	583	143.2	48.52	12.05×12.03	145	142,100	980	Opened oblique cracks along the lower half of column.
8951	4	48	.....do.....	584	143.6	48.58	12.04×12.02	144.7	135,400	936	Opened cracks near the middle of its length.
8948	6	48	.....do.....	894	146.2	72.35	12.10×12.07	146	165,200	1,131	Do.
8949	6	48	.....do.....	890	146	72.24	12.06×12.09	145.8	174,960	1,200	Opened cracks 18″ from the top end.
8938	8	42	.....do.....	1,187	145.6	96.17	12.05×12.16	146.5	162,400	1,108	Opened cracks 22″ from the bottom end of the column.
8939	8	42	.....do.....	1,193	146.1	96.20	12.18×12.04	146.6	159,200	1,086	Opened cracks at the bottom end of the column.
8936	10	41	.....do.....	1,484	146	120.30	12.05×12.12	146	148,200	1,015	Opened cracks 18″ from lower end of column.
8937	10	42	.....do.....	1,487	146.2	120.36	12.09×12.08	146	146,000	1,000	Opened cracks near the bottom end of column.
8934	12	37	.....do.....	1,814	148.8	144.29	12.10×12.07	146	204,400	1,400	Opened cracks along 30″ at upper end of column, finally separating with an oblique fracture, making an angle of about 35 degrees with axis of column.
8935	12	39	.....do.....	1,800	148.2	144.40	12.07×12.04	145.3	216,000	1,500	Opened oblique cracks along 30″ of length at upper end of column.
8930	14	35	.....do.....	2,107	148.4	168.27	12.06×12.09	145.8	125,100	858	Developed cracks at the lower end, the cracks extending along the column a distance of 2 feet.
8931	14	35	.....do.....	2,112	147.8	168.62	12.05×12.15	146.4	118,200	807	Opened cracks between 6″ and 24″ of the lower end of column.

MACHINE-MIXED CONCRETE COLUMNS OF DIFFERENT COMPOSITION.

8940	6	42	1 cement, 6 gravel, 8 1½" broken stone, 4 ⅜" broken stone.	869	142.6	72.48	12.05×12.06	145.3	72,650	500	Opened cracks 15" from the bottom end of column.
8941	6	42	.....do	870	143.5	72.50	12.04×12.00	144.5	67,600	467	Opened cracks 18" from the bottom end of column.
8942	6	42	1 cement, 7 gravel, 8½ 1½" broken stone, 4½ ⅜" broken stone.	862	140.8	72.44	12.05×12.12	146	62,400	427	General cracks developed along middle half of its length.
8943	6	42	.....do	866	141.9	72.47	12.06×12.07	145.5	63,400	436	Opened cracks 12" to 24" from the upper end of column.
8944	6	45	1 cement, 5 gravel, 6½ 1½" broken stone, 3½ ⅜" broken stone.	887	145.9	72.45	12.05×12.04	145	102,600	708	Opened cracks 1 foot from the middle of its length.
8945	6	45	.....do	893	145.5	72.42	12.13×12.07	146.4	109,300	747	Opened cracks along middle part of its length.
8946	6	46	1 cement, 4 gravel, 5½ 1½" broken stone, 2½ ⅜" broken stone.	885	145.7	72.30	12.06×12.04	145.2	130,690	900	Do.
8947	6	46	.....do	884	144.8	72.39	12.08×12.06	145.7	116,200	797	Opened cracks near the middle of its length.

MACHINE-MIXED CONCRETE COLUMNS STRENGTHENED WITH 4 BARS ¾" COLD TWISTED STEEL EMBEDDED IN THE CONCRETE.

8932	12	36	1 cement, 3 gravel, 6-¾" broken stone.	1,818	150.1	144.37	12.04×12.05	145	181,300	1,250	Opened cracks within a section 18" long at the upper end of the column.
8933	12	39	.....do	1,812	149.4	144.23	12.04×12.07	145.3	247,010	1,700	Opened cracks 20" from lower end of column, which were followed by buckling of the twisted steel rods.

NOTE—The twisted steel rods in column No. 8932 took a bearing at the lower end of the column, but did not reach flush with the upper end, ending about ½" below the top surface.

In column No. 8933 iron plates 2" by 2" by ½" to ⅝" thickness were used, one on the upper end of each twisted rod, to level the top and bring the twisted rods to an initial bearing on the buttress of the testing machine.

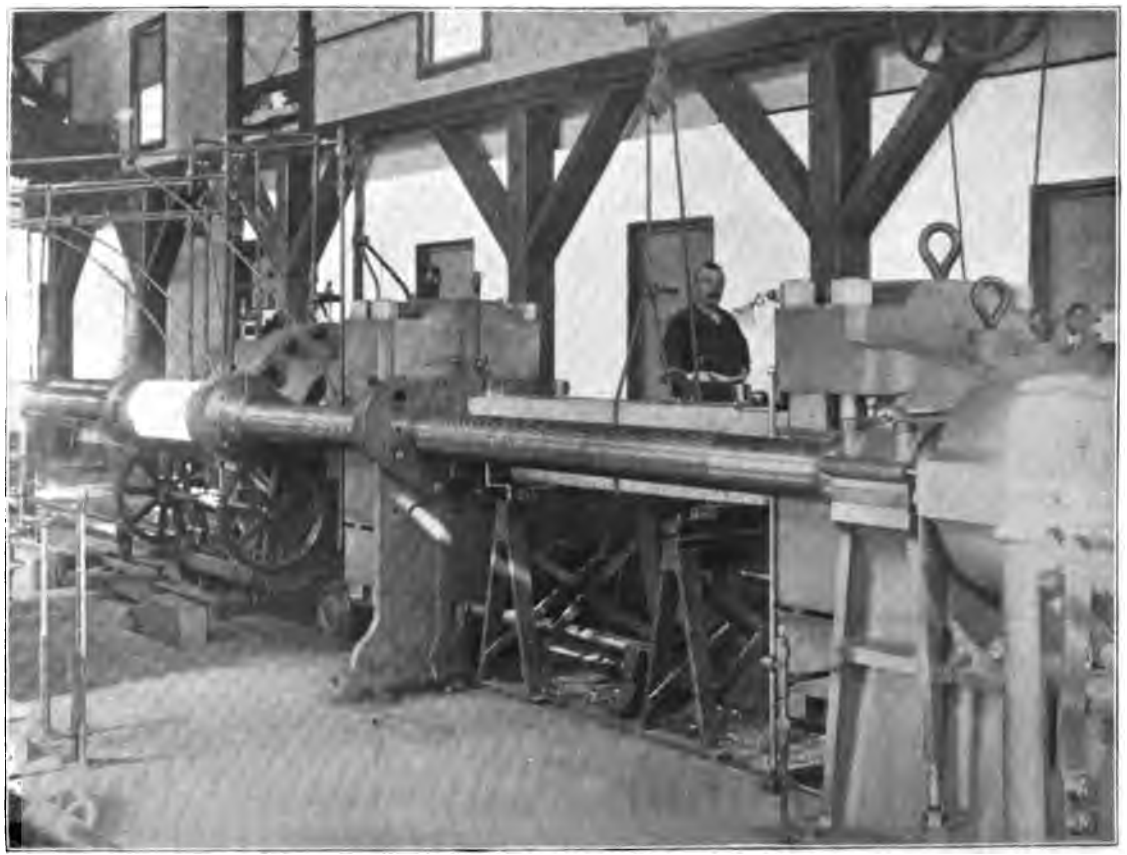
COMPRESSION TESTS

OF

CONCRETE CUBES AND CONCRETE COLUMNS

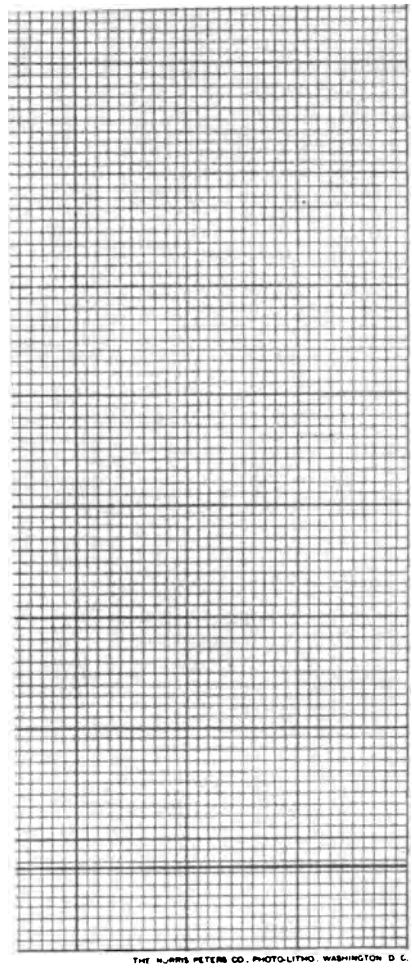
FROM

SOOYSMITH AND COMPANY, NEW YORK CITY.



CONCRETE COLUMN NO. 9318 DURING THE TEST.

6



THE H. ARMS PETERS CO. PHOTO-LITHO. WASHINGTON D. C.

Compression Test of Column Built of Nine 12″ Cubes of Cement Concrete.

Composition of concrete:

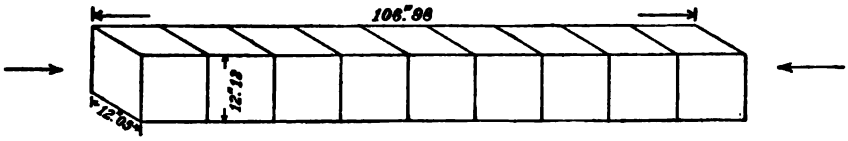
	Parts.
Silica Portland cement	1
Coarse, clean, grit sand from Port Eaton, L. I	2
Quartz gravel from Port Eaton, L. I	3

The gravel varies in size from ½″ to 2″ diameter.

The silica Portland cement consists of 1 part Aalborg Portland cement and 1 part of clean quartz sand ground together to such fineness that only about 1 per cent of the mixture remains in a No. 100 sieve.

Joints made with neat Portland cement.

No. 9318.

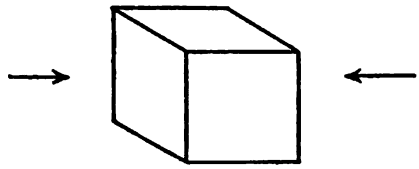


Weight, 1,298 pounds=143.6 pounds per cubic foot.
Counterweight at the middle, 400 pounds.
Sectional area 12″.05 by 12″.12=146 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
7,300	50	0.	0.	Initial load.
14,600	100	.0005	.....	
29,200	200	.0019	.....	
43,800	300	.0032	.....	
58,400	400	.0047	.....	
73,000	500	.0060	.....	
7,300	50	.....	.0005	
87,600	600	.0073	.....	
102,200	700	.0088	.....	
116,800	800	.0102	.....	
131,400	900	.0118	.....	
146,000	1,000	.0135	.....	
7,300	50	.....	.0018	
160,600	1,100	.0156	.....	
175,200	1,200	.0172	.....	
189,800	1,300	.0189	.....	
204,400	1,400	.0204	.....	
219,000	1,500	.0224	.....	
7,300	50	.....	.0037	
233,600	1,600	.0241	.....	
248,200	1,700	.0263	.....	
262,800	1,800	.0287	.....	
277,400	1,900	.0312	.....	
292,000	2,000	.0335	.....	
7,300	50	.....	.0070	
306,600	2,100	.0370	.....	
321,200	2,200	.0399	.....	
335,800	2,300	.0437	.....	
350,400	2,400	.0485	.....	
365,000	2,500	.0540	.....	
7,300	50	.....	.0158	
372,000	2,548	.....	.....	Ultimate strength.

Fourth cube from the top and cube at middle of length fractured, opening oblique fractures.

Compression of Concrete Cubes.



SILICA-PORTLAND CEMENT CONCRETE.

No. of test.	Marks.	Weight.		Dimensions.			Sectional area.	First crack.	Ultimate strength.	
		Total.	Per cubic foot.	Height.	Compressed surface.				Total.	Per square inch.
		Lbs.	*Lbs.*	*Inches.*	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
9319	No. 62	.....	.....	12.20	12.15	12.08	146.77	390,000	417,900	2,847
9320	No. 71	145	142.5	12.10	12.06	12.05	145.32	382,000	428,900	2,951
9321	No. 70	144	142.8	11.90	12.10	12.10	146.41	518,000	552,000	3,770

ALSEN'S CEMENT CONCRETE.

9322	A 12—4	148	149.2	11.80	12.02	12.06	145.20	378,100	378,100	2,604
9323	A 12—3	147	148.4	11.75	12.05	12.09	145.68	379,000	380,400	2,611
9976	A 11—1	147	147.4	11.76	12.12	12.09	146.53	294,000	315,800	2,155
9977	A 11—2	148½	146.4	11.98	12.12	12.07	146.29	252,100	252,100	1,728
9994	A 12—1	149	147.6	11.95	12.07	12.09	145.93	304,000	308,100	2,111
9995	A 12—2	150	148.0	12.02	12.08	12.06	145.68	289,000	300,100	2,059

CEMENTS.

TENSION AND COMPRESSION TESTS AND CHEMICAL ANALYSES.

TENSION TESTS.

ACME CEMENT FROM SALIMA ON GYPSUM CITY, KANS.

Material marked "Acme Cement Plaster Co."

BRIQUETTES 7 DAYS OLD. SET IN AIR.

No. 8616.

Dimensions.		Sectional area.	Tensile strength.			Remarks.
Width.	Thickness.		Total.	Per square inch.	Mean.	
Inches.	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
1.02	1.02	1.04	281	270		
1.00	1.02	1.02	320	314		
1.00	1.07	1.07	479	448	339	
1.00	1.06	1.06	283	267		
.99	1.02	1.02	402	398		

CEMENT FROM C. A. BROCKETT CEMENT COMPANY, KANSAS CITY, MO. WORKS AT FORT SCOTT, KANS.

Material marked "Fort Scott Hydraulic Cement. Double Star brand."

BRIQUETTES 7 DAYS OLD. SET IN AIR.

No. 8617.

Dimensions.		Sectional area.	Tensile strength.			Remarks.
Width.	Thickness.		Total.	Per square inch.	Mean.	
Inch.	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
.93	1.06	.99	104	105		
.94	1.06	1.00	110	110		
.95	1.05	1.00	144	144	135	
.96	1.06	1.02	172	169		
.97	1.03	1.00	149	149		

Cement from Best Brothers & Co., Medicine Lodge, Kans.

Material marked "Best's Keenes Cement, No. 2 grade."

BRIQUETTES 7 DAYS OLD. SET IN AIR.

No. 8618.

Dimensions.		Sectional area.	Tensile strength.			Remarks.
Width.	Thickness.		Total.	Per square inch.	Mean.	
Inches.	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
.96	1.12	1.07	452	422		
1.00	1.16	1.16	198	171		
.96	1.15	1.10	297	270	294	
.94	1.12	1.05	266	253		
1.00	1.12	1.12	398	355		

Alpha Portland Cement from James A. Davis & Co., Boston, Mass. Agents Whittaker Cement Co., Phillipsburg, Pa.

BRIQUETTES 7 DAYS OLD. SET IN AIR.

No. 8619.

Dimensions.		Sectional area.	Tensile strength.			Remarks.
Width.	Thickness.		Total.	Per square inch.	Mean.	
Inch.	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
.88	1.03	.91	270	297		
.85	1.04	.88	239	272	283	
.98	1.02	1.00	302	302		
.92	1.04	.96	251	261		

BRIQUETTES 22 PER CENT WATER, 24 HOURS OLD. SET IN AIR.

No. 8751.

1.00	1.07	1.07	181	169		
1.01	1.11	1.12	233	208		
1.03	1.03	1.06	202	191	191	
1.00	1.05	1.05	206	196		

PORTLAND CEMENT, MANUFACTURED BY CALIFORNIA PORTLAND CEMENT COMPANY, LOS ANGELES, CAL. FACTORY AT COLTON, CAL.

BRIQUETTES 7 DAYS OLD. SET IN AIR.

No. 8620.

Dimensions.		Sectional area.	Tensile strength.			Remarks.
Width.	Thickness.		Total.	Per square inch.	Mean.	
Inch.	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
.92	1.07	.98	88	90		
.95	1.02	.97	87	90		
.96	1.04	1.00	83	83	91	
.93	1.04	.97	135	139		
.90	1.06	.95	51	54		

MATERIAL SUBMITTED BY BERRY & FERGUSON, BOSTON, MASS.

BRIQUETTES 24 HOURS OLD. SET IN AIR.

No. 8686.

Marks.	Dimensions.		Sectional area.	Tensile strength.			Remarks.
	Width.	Thickness.		Total.	Per square inch.	Mean.	
	Inches.	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
German	1.08	1.09	1.18	94	80	92	
	1.05	1.00	1.05	98	93		
	1.04	1.03	1.07	110	103		

No. 8687.

No. 1	1.04	1.00	1.04	69	66	83	
	1.05	1.01	1.06	107	101		

No. 8688.

No. 2	1.09	.99	1.08	75	69	59	
	1.06	.99	1.05	53	50		

No. 8689.

No. 4	1.08	.99	1.07	126	118	107	
	1.07	1.00	1.07	103	96		

No. 8690.

Aberthaw Construction Co. No. 1.	1.07	1.02	1.09	123	113	127	
	1.09	.96	1.07	151	141		

BRIQUETTES 24 HOURS OLD, SET IN AIR—Continued.

No. 8691.

Marks.	Dimensions.		Sectional area.	Tensile strength.			Remarks.
	Width.	Thickness.		Total.	Per square inch.	Mean.	
	Inches.	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
Aberthaw Construction Co. No. 2.	1.02	1.03	1.05	147	140	144	From open barrel.
	1.03	1.00	1.03	154	149		

No. 8692.

Aberthaw Construction Co. No. 3.	1.03	1.01	1.04	137	132	92	Contains sticks and straw.
	1.05	1.00	1.05	52	49		

No. 8693.

Aberthaw Construction Co. No. 4.	1.04	1.00	1.04	132	127	109	
	1.05	.99	1.04	110	106		
	1.05	1.00	1.05	98	93		

No. 8694.

Crescent cement	1.05	.99	1.04	59	57	100	
	1.02	1.05	1.07	141	132		
	1.00	1.09	1.09	136	125		
	1.02	1.07	1.09	116	106		
	1.05	1.08	1.08	86	80		

BRIQUETTES 8 DAYS OLD. SET IN AIR.

No. 8709.

German	.96	1.10	1.06	269	254	253	
	.97	1.06	1.03	292	283		
	.98	1.05	1.03	239	232		
	.98	1.05	1.03	251	244		

No. 8710.

No. 1	.98	1.04	1.02	204	200	204	
	.99	1.08	1.07	223	208		

No. 8711.

No. 2	.96	1.09	1.05	229	218	.....	

No. 8712.

No. 4	1.02	1.03	1.05	224	213	.....	

BRIQUETTES, 8 DAYS OLD. SET IN AIR—Continued.

No. 8713.

Marks.	Dimensions.		Sectional area.	Tensile strength.			Remarks.
	Width.	Thickness.		Total.	Per square inch.	Mean.	
	Inches.	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
Aberthaw Construction Co. No. 1.	1.00	1.03	1.03	185	180	202	
	1.02	1.03	1.05	236	225		

No. 8714.

Aberthaw Construction Co. No. 2.	1.00	1.03	1.03	234	227	261	From open barrel.
	1.02	1.03	1.05	310	295		

No. 8715.

Aberthaw Construction Co. No. 3.	.99	1.05	1.04	276	265	243	Contained sticks.
	1.00	1.05	1.05	281	268		
	1.01	1.03	1.04	158	152		

No. 8716.

Aberthaw Construction Co. No. 4.	.98	1.07	1.05	329	313	295	
	1.02	1.02	1.04	289	278		

No. 8717.

Crescent cement	1.02	1.04	1.06	202	191	203	
	1.03	1.05	1.08	199	184		
	1.06	1.01	1.07	266	249		
	1.02	1.03	1.05	195	186		

BRIQUETTES 1 MONTH 3 DAYS OLD. SET IN AIR.

No. 8734.

German	1.12	.95	1.06	238	224	262	
	1.04	1.01	1.05	353	336		
	1.02	.98	.95	259	273		
	1.06	.97	1.03	220	214		

No. 8735.

No. 1	1.08	1.00	1.08	271	250	220	
	1.06	.98	1.04	198	190		

No. 8736.

No. 2	1.05	.95	1.00	224	224	.....	

BRIQUETTES 1 MONTH 3 DAYS OLD. SET IN AIR—Continued.

No. 8737.

Marks.	Dimensions.		Sectional area.	Tensile strength.			Remarks.
	Width.	Thickness.		Total.	Per square inch.	Mean.	
	Inches.	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
No. 4	1.09	.95	1.03	245	238	247	
	1.02	1.00	1.02	261	256		

No. 8738.

Aberthaw Construction Co. No. 1.	1.01	1.03	1.04	286	275	295	
	1.04	1.03	1.07	302	282		
	1.04	1.02	1.06	348	328		

No. 8739.

Aberthaw Construction Co. No. 2.	1.00	1.05	1.05	351	334	311	From open barrel.
	1.02	1.00	1.02	305	299		
	1.01	1.04	1.05	314	299		

No. 8740.

Aberthaw Construction Co. No. 3.	1.01	1.00	1.01	302	299	350	Contained sticks.
	1.03	.95	.98	254	259		
	1.03	1.03	1.06	204	192		

No. 8741.

Aberthaw Construction Co. No. 4.	1.02	1.02	1.04	205	197	243	
	1.05	1.00	1.05	303	289		

No. 8742.

Crescent cement	1.04	1.02	1.06	174	164	187	
	1.01	1.08	1.09	159	146		
	1.02	1.08	1.10	265	241		
	1.04	1.04	1.08	241	223		
	1.06	1.03	1.09	174	160		

Fineness Tests of Cement.

Marks.	Residue in sieves.				
	100 mesh.	80 mesh.	60 mesh.	40 mesh.	20 mesh.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
German	7.5	5.0	0	.....	.....
Crescent	17.5	12.0	9.5	5.5	0

CEMENT AND CEMENT MORTAR USED IN CONSTRUCTION OF WATERTOWN ARSENAL WHARF.

BRIQUETTES 24 HOURS OLD. SET IN AIR.

No. 8750.

Portland cement, 22 per cent water.

Dimensions.		Sectional area.	Tensile strength.			Remarks.
Width.	Thickness.		Total.	Per square inch.	Mean.	
Inches.	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
1.08	.96	1.04	231	222	212	
1.08	.97	1.05	221	210		
1.06	.97	1.03	194	188		
1.05	.98	1.03	236	229		

BRIQUETTES SET 1 DAY IN AIR, 3 DAYS IN WATER.

No. 8749.

Portland cement 1, sand 1.

.94	1.09	1.02	102	100	122	
1.00	1.02	1.02	109	107		
1.01	1.03	1.04	129	124		
1.13	.91	1.03	116	113		
1.07	.94	1.01	119	118		
1.11	.92	1.02	132	129		
1.03	.99	1.02	133	130		
1.10	.95	1.04	133	128		
1.00	1.03	1.03	132	129		
1.00	1.04	1.04	152	146		

BRIQUETTES 8 DAYS OLD. SET 1 DAY IN AIR, 7 DAYS IN WATER.

No. 8754.

Rosendale cement 1, sand 1½.

1.01	1.04	1.05	23	22	23	Mixed on the wharf.
1.00	1.03	1.03	28	27		
1.00	1.03	1.03	21	20		

No. 8755.

Portland cement 1, sand 1.

1.00	1.02	1.02	176	173	172	
1.00	1.02	1.02	186	182		
1.00	1.02	1.02	169	166		
1.00	1.04	1.04	172	165		

BRIQUETTES 9 DAYS OLD. SET 2 DAYS IN AIR, 7 DAYS IN WATER.

No. 8751.

Portland cement, 1; sand, 1; water, 25 per cent in weight of the neat cement.

Dimensions.		Sectional area.	Tensile strength.			Remarks.
Width.	Thickness.		Total.	Per square inch.	Mean.	
Inches.	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
1.00	1.01	1.01	245	243	230	Mixed in the testing laboratory.
1.00	1.01	1.01	227	225		
1.00	1.01	1.01	252	250		
1.00	1.01	1.01	204	202		

No. 8752.

Portland cement, 1; sand, 1; water, 31¼ per cent in weight of neat cement.

.99	1.00	.99	208	210	236	Mixed in the testing laboratory.
1.00	1.00	1.00	249	249		
.99	1.02	1.01	250	248		
.99	1.02	1.01	239	237		

No. 8753.

Portland cement, 1; sand, 1; water, 28⅛ per cent in weight of the neat cement.

1.01	1.02	1.03	192	187	231	Mixed in the testing laboratory.
1.01	1.02	1.03	262	254		
1.01	1.02	1.03	251	244		
1.00	1.00	1.00	238	238		

COMPRESSION TESTS.

ACME CEMENT FROM SALIMA OR GYPSUM CITY, KANS.

Material marked "Acme Cement Plaster Co."

CUBES 7 DAYS OLD. SET IN AIR.

No. 8622.

Dimensions.			Sectional area.	First crack.	Ultimate strength.	
Height.	Compressed surface.				Total.	Per square inch.
Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
3.90	4.00	4.04	16.16	30,950	30,950	1,915
3.94	4.00	4.01	16.04	35,680	35,680	2,224

CEMENT FROM C. A. BROCKETT CEMENT COMPANY, KANSAS CITY, MO. WORKS AT FORT SCOTT, KANS.

Material marked "Fort Scott Hydraulic Cement. Double Star Brand."

CUBES 7 DAYS OLD. SET IN AIR.

No. 8623.

Dimensions.			Sectional area.	First crack.	Ultimate strength.	
Height.	Compressed surface.				Total.	Per square inch.
Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
4.06	4.02	4.03	16.20	14,020	14,020	865
4.05	4.00	4.00	16.00	14,300	15,060	941

CEMENT FROM BEST BROTHERS & CO., MEDICINE LODGE, KANS.

Material marked "Best's Keenes Cement, No. 2 grade."

CUBES 7 DAYS OLD. SET IN AIR.

No. 8624.

Dimensions.			Sectional area.	First crack.	Ultimate strength.	
Height.	Compressed surface.				Total.	Per square inch.
Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
4.07	4.00	4.03	16.12	20,800	20,800	1,290
4.09	4.04	4.05	16.36	9,200	10,350	633

ALPHA PORTLAND CEMENT, FROM JAMES A. DAVIS & CO., BOSTON, MASS. AGENTS, WHITTAKER CEMENT COMPANY, PHILLIPSBURG, PA.

CUBES 7 DAYS OLD. SET IN AIR.

No. 8625.

Dimensions.			Sectional area.	First crack.	Ultimate strength.	
Height.	Compressed surface.				Total.	Per square inch.
Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
4.04	3.98	3.96	15.76	55,980	55,980	3,552
4.02	4.00	3.96	15.84	55,760	55,760	3,520

PORTLAND CEMENT, MANUFACTURED BY CALIFORNIA PORTLAND CEMENT COMPANY, LOS ANGELES, CAL. FACTORY AT COLTON, CAL.

CUBES 7 DAYS OLD. SET IN AIR.

No. 8626.

Dimensions.			Sectional area.	First crack.	Ultimate strength.	
Height.	Compressed surface.				Total.	Per square inch.
Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
4.03	4.00	4.00	16.00	6,590	6,590	412
4.03	3.99	3.94	15.73	6,100	7,190	457

A. J. SNYDER & SONS' CRESCENT BRAND. ROSENDALE CEMENT, FROM BERRY & FERGUSON, BOSTON, MASS.

CUBES 7 DAYS OLD. SET IN AIR.

No. 8627.

Dimensions.			Sectional area.	First crack.	Ultimate strength.	
Height.	Compressed surface.				Total.	Per square inch.
Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
4.00	3.98	3.98	15.84	12,000	13,040	823
4.02	4.00	4.02	16.08	11,750	11,750	731

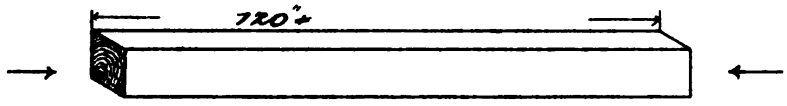
CHEMICAL ANALYSES OF CEMENTS.

Description.	Tension test No.	Silica.	Oxide of iron.	Alumina.	Lime.	Magnesia.	Sulphur, trioxide.	Manganous oxide	Carbon dioxide.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Acme cement, from Acme Cement Plaster Co., Salina or Gypsum City, Kans	.....	7.10	Trace.	8.19	36.54	Trace.	44.20	.....	3.90
Fort Scott hydraulic cement, Double Star brand, from C. A. Brockett Cement Co., Kansas City, Mo	.....	21.07	3.05	10.85	49.20	7.90	.....	.....	7.27
Best's Keene's cement, No. 2 grade, from Best Brothers & Co., Medicine Lodge, Kans	.....	Trace.	None.	Trace.	42.04	Trace.	56.54	.....	1.37
Alpha Portland cement, from James A. Davis & Co., Boston, Mass., agents Whittaker Cement Co., Phillipsburg, Pa	.....	20.02	2.70	10.50	52.85	10.00	1.13	0.45	2.34
Portland cement, manufactured by California Portland Cement Co., Los Angeles, Cal	.....	20.88	2.50	20.35	38.87	13.20	1.05	0.52	2.61
A. J. Snyder & Sons' Crescent brand Rosendale cement, from Berry & Ferguson, Boston, Mass	.....	20.50	3.50	14.70	35.66	20.26	.....	.....	5.38

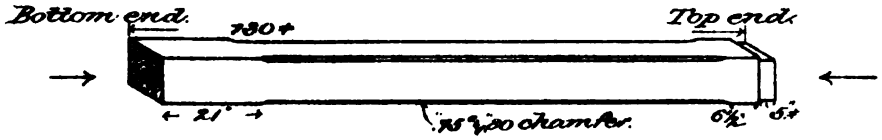
COMPRESSION TESTS OF TIMBER POSTS.

Timber Posts.

New posts.



Old posts.



THE HORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

TIMBER POSTS.

These tests were undertaken to supply further data on the strength of full-sized wooden posts, obtain comparative results on sticks from different parts of the same tree, show the relative strength of long-leaf pine, short-leaf pine, and spruce, and the strength of old pine posts, some of which had been charred by fire, taken from a building where they had been in service for a term of years.

Of the new posts, those designated as from the yard were shipped from Fernandina, Fla., and had been in a yard for about two years before testing. The other long-leaf pine sticks came from Savannah, Ga., and the short-leaf pine from Baileys Mills, on the Satilla River, Georgia.

The latter two groups of sticks were tested directly upon their arrival in Boston, the port to which they were shipped.

The old pine posts were taken from building No. 394 Federal street, Boston, which was built by the Boston Fire Brick Company, a four-story brick structure, completed March, 1885. This building was taken down in June, 1897.

Soon after the completion of the building a fire occurred in the upper stories. The charred posts remained in use thereafter. The posts nominally 9″ by 9″ were taken from the second story; those nominally 7″ by 7″ were from the third story of the building. The upper story of this building had been occupied by running machinery.

Among the new long-leaf pine posts the maximum compressive strength found was 4,976 pounds per square inch; the minimum, 3,369. The strength of the old long-leaf pine posts ranged from 5,400 to 7,354 pounds per square inch, one of the charred posts failing at 4,878 pounds per square inch.

The short-leaf pine posts ranged from 2,600 to 4,000 pounds, while the spruce posts gave results between the limits of 1,900 and 3,300 pounds per square inch.

Averaging the results of all the posts of each class and we have: Long-leaf pine, new posts, 4,038 pounds per square inch; short-leaf pine, new posts, 3,349 pounds per square inch; spruce, new posts, 2,654 pounds per square inch; long-leaf pine, old posts, 6,093 pounds per square inch; long-leaf pine, old posts charred by fire, 5,656 pounds per square inch.

One of the old long-leaf pine posts, not included in the above average, was immersed in water for a period of one hundred and thirty days prior to testing. This failed at 3,800 pounds per square inch.

Comparing posts taken from different parts of the height of the tree, the stronger sticks were from the butts, the strength decreasing in those which came successively from the middle and tops of the trees.

Similar results are also shown in respect to the rigidity of the timber, the highest values of the modulus of elasticity being found in the posts from the butts, the lowest values in sticks from the tops.

In the table of moduli of elasticity of long-leaf pine posts, the values are seen to diminish as the compression loads are increased.

These values are based on the resilience of the material, the difference between the mean total resilience at two adjacent loads being used in the computation of the modulus of elasticity for that increment or interval of load.

Knots obscure these tendencies in some of the timber, cause loss in strength, and locate the initial places of fracture.

The percentages of moisture in the wood was ascertained from slices cut from the posts near the place of fracture. Slices about ¾″ to 1″ long were sawed out including the full cross-section dimensions of the posts, and these slices were exposed to a drying temperature of about 220° F. until they had practically ceased to lose weight.

The short-leaf pine posts experienced the greatest loss in weight during the period of drying, and it was shown that the sticks from the yard did not fall much below the other long-leaf pine in respect to their loss of moisture. The old posts were in a very dry state when tested, the loss in weight ranging from nothing to about 8 per cent.

Long-leaf pine post No. 9208 was exposed to loads of longer duration than commonly applied. It remained under 3,000 pounds per square inch compression for a period of one hour. The immediate effect on the compressibility of the post was materially increased within five minutes after that, while the post continued to shorten, the rate was slow and showed no further gain during the last twenty minutes of the time.

The load was increased to 3,200 pounds per square inch, and after a number of observations on the compressibility of the post were made the load was left on for a period of forty hours. At the expiration of that time the load found on the post was 3,059 pounds per square inch. A slight escape of oil in the straining cylinder of the testing machine, together with any further yielding of the post, would cause this reduction in total load.

When the load was restored to 3,200 there was no further compressibility observed during an interval of twenty minutes. From this point in the test until the ultimate strength was reached, each increment of load was sustained until two micrometer observations were made, the second reading in each case showing slight additional compressibility.

Similar observations were carried out with spruce post No. 9193.

A load of 2,000 pounds per square inch was sustained for a period of three hours, during which time there was slight but continuous yielding. Then followed an interval of forty hours under diminished load, after which the load was restored to 2,000 pounds per square inch. During the eight hours which followed there was additional yielding of the wood.

The load was eventually increased to 2,300 pounds per square inch, which was sustained one hour and thirty minutes, gradual yielding still going on. Reducing the load to 2,000 pounds per square inch again, a partial recovery in length followed. At the end of two hours and fifteen minutes, however, a part of the immediate recovery in length was lost, and further yielding was in progress.

The post ultimately failed under 2,300 pounds per square inch, the fibers crushing at a group of knots which were located outside the 50″ gauged length on which the compressibility was observed.

The water-soaked post from the cistern crushed the fibers at the lower end. Water was forced out of the post more profusely in the vicinity of the place of fracture than elsewhere, and when the fibers were visibly crushed water dripped rapidly from that locality.

It will be seen that the older and dryer posts gave higher average strength than the less thoroughly seasoned sticks. The manner of failure was different in these two classes of posts.

Greater toughness of the fibers was possessed by the new posts and their failures were of a more distinct local character, whereas the older and dry sticks soon after the first visible evidences of failure fractured both by local crushing of the fibers and more or less general splitting along the grain.

The shattered condition of two of the old posts is shown on the photographs accompanying the details of the tests.

Long-Leaf Pine Posts.

MEAN COMPRESSIVE RESILIENCE AND MODULI OF ELASTICITY OF POSTS FROM TOPS AND BUTTS OF TREES.

POSTS FROM TOPS OF TREES.

Applied loads per square inch.	Resilience.						Successive difference in mean resilience.	Modulus of elasticity per square inch.
	No. 9170.	No. 9171.	No. 9172.	No. 9175.	No. 9204.	Mean.		
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Pounds.*
20	0.	0.	0.	0.	0.	0.	0.	
500	.0117	.0140	.0119	.0120	.0139	.0127	.0127	1,890,000
1,000	.0260	.0300	.0266	.0262	.0295	.0277	.0150	1,667,000
2,000	.0566	.0626	.0572	.0579	.0620	.0593	.0316	1,582,000
3,000	.0898	.0977	.0901	.0916	.0954	.0929	.0336	1,488,000

POSTS FROM BUTTS OF TREES.

Applied loads per square inch.	Resilience.						Successive difference in mean resilience.	Modulus of elasticity per square inch.
	No. 9168.	No. 9173.	No. 9174.	No. 9176.	No. 9208.	Mean.		
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Pounds.*
20	0.	0.	0.	0.	0.	0.	0.	
500	.0095	.0111	.0120	.0098	.0109	.0107	.0107	2,243,000
1,000	.0196	.0233	.0227	.0198	.0237	.0218	.0111	2,252,000
2,000	.0412	.0485	.0442	.0404	.0508	.0450	.0232	2,155,000
3,000	.0644	.0744	.0667	.0621	.0792	.0694	.0244	2,049,000

MEAN COMPRESSIVE RESILIENCE AND MODULI OF ELASTICITY.

SHORT LEAF PINE POSTS.

Applied loads per square inch.	Resilience.							Successive difference in mean resilience.	Modulus of elasticity per square inch.
	From same tree.			From same tree.			Mean		
	Top No. 9198.	Middle No. 9197.	Butt No. 9199.	Top No. 9202.	Middle No. 9200.	Butt No. 9201.			
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Pounds.*
20	0.	0.	0.	0.	0.	0.	0.	0.	.....
500	.0145	.0161	.0170	.0156	.0114	.0123	.0145	.0145	1,655,000
1,000	.0323	.0337	.0347	.0324	.0242	.0250	.0304	.0159	1,572,000
2,000	.0710	.0735	.0732	.0684	.0510	.0524	.0649	.0345	1,449.000
3,000	.....	.1242	.1398	.1079	.0792	.0821	.1065	.0416	1,202,000

SPRUCE POSTS.

Applied loads per square inch.	Resilience.										Successive difference in mean resilience.	Modulus of elasticity per square inch.
	No. 9177.	From same stick.		From same stick.		From same stick.		From same stick.		No. 9193.	Mean.		
		No. 9188.	No. 9190.	No. 9189.	No. 9196.	No. 9191.	No. 9195.	No. 9192.	No. 9194.				
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Pounds.*
20	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	.....
500	.0185	.0148	.0122	.0113	.0139	.0198	.0208	.0133	.0136	.0156	.0154	.0154	1,558,000
1,000	.0384	.0301	.0264	.0262	.0267	.0405	.0434	.0282	.0266	.0333	.0320	.0166	1,506,000
1,500	.0590	.0462	.0416	.0417	.0399	.0616	.0690	.0432	.0398	.0519	.0494	.0174	1,437,000
2.000	.0819	.0628	.0562	.0535	.0528	.0858	.....	.0591	.0537	.0785	.0648	.0154	1,623,000

OLD YELLOW PINE POSTS FROM BOSTON FIRE BRICK COMPANY'S BUILDING, BOSTON, MASS.

MEAN COMPRESSIVE RESILIENCE AND MODULI OF ELASTICITY.

Applied loads per square inch.	Resilience.													Successive difference in mean resilience.	Modulus of elasticity per square inch.
	No. 9308.	No. 9309.	No. 9310.	No. 9311.	No. 9312.	No. 9313.	No. 9314.	No. 9315.	No. 9316.	No. 9328.	No. 9329.	No. 9330.	Mean.		
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Pounds.*
20	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	.....	.....
1,000	.0174	.0242	.0190	.0193	.0233	.0283	.0227	.0230	.0198	.0228	.0213	.0194	.0213	.0213	2,300,000
3,000	.0556	.0722	.0581	.0590	.0718	.0733	.0689	.0729	.0613	.0702	.0668	.0598	.0658	.0445	2,247,000
5,000	.0966	.1227	.0974	.1019	.....	.1240	.1164	.1224	.1028	.1181	.1172	.1030	.1111	.0458	2,207,000

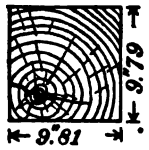
NEW POSTS

OF

YELLOW PINE AND SPRUCE.

No. 9168.

LONG LEAF PINE.



Shaky end.

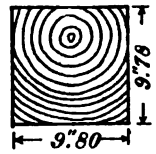
Post from butt of tree.
Length, 119″.78.
Weight, 330 pounds = 49″.5 pounds per cubic foot.
Counter weight at middle, 165 pounds.
Average weight of growth, 8 rings per inch.
Sectional area, 9″.79 × 9″.81 = 96.04 square inches.
Gauged length, 50″.
Taken from same 30-foot stick as Nos. 9169 and 9170.
Clear stick, free from knots.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,920	20	0.	0.	0.	0.	Initial load
9,604	100	.0016	.....	.....	.....	
19,210	200	.0035	.....	.....	.....	
28,810	300	.0056	.....	.....	.....	
38,420	400	.0075	.....	.....	.....	
48,020	500	.0096	.....	0.	0.	
1,920	20	.....	.0001	.....	.....	
57,620	600	.0116	.....	.....	.....	
67,230	700	.0135	.....	.....	.....	
76,830	800	.0156	.....	.....	.....	
86,440	900	.0177	.....	.....	.....	
96,040	1,000	.0198	.....	0.	0.	
1,920	20	.....	.0002	.....	.....	
115,250	1,200	.0238	.....	.....	.....	
134,460	1,400	.0283	.....	.....	.....	
153,660	1,600	.0328	.....	.....	.....	
172,870	1,800	.0371	.....	.....	.....	
192,080	2,000	.0417	.....	0.	0.	
1,920	20	.....	.0005	.....	.....	
211,290	2,200	.0460	.....	.01	0.	
230,500	2,400	.0506	.....	.....	.....	
249,700	2,600	.0554	.....	.02	0.	
268,910	2,800	.0600	.....	.03	0.	
288,120	3,000	.0650	.....	.03	0.	
1,920	20	.....	.0006	.....	.....	
307,230	3,200	.0690	.....	.....	.....	
326,540	3,400	.0735	.....	.....	.....	
345,740	3,600	.0784	.....	.04	0.	
364,950	3,800	.0830	.....	.04	0.	
384,160	4,000	.0877	.....	.04	.03	
1,920	20	.....	.0011	.....	.....	
403,370	4,200	.....	.....	0.	.20	Ultimate strength.

Fibers crushed at the upper end of the post as it stood in the tree.

No. 9169.

LONG-LEAF PINE.



Post from middle of tree.
Length, 119".64.
Weight, 302 pounds = 45.5 pounds per cubic foot.
Counterweight at middle, 151 pounds.
Average rate of growth, 8 rings per inch.
Sectional area, 9".78 × 9".80 = 95.84 square inches.
Gauged length, 50".
Taken from same 30-foot stick as Nos. 9168 and 9170.
Post contains 9 knots from $\frac{3}{8}$" to $1\frac{1}{4}$" diameter.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,917	20	0.	0.	0.	0.	Initial load.
9,584	100	.0027	.....	.....	.....	
19,168	200	.0056	.....	.....	.....	
28,752	300	.0084	.....	.....	.....	
38,336	400	.0111	.....	.....	.....	
47,920	500	.0138	.....	0.	0.	
1,917	20	.....	.0001	.....	.....	
57,504	600	.0163	.....	.....	.....	
67,088	700	.0189	.....	.....	.....	
76,672	800	.0215	.....	.....	.....	
86,256	900	.0240	.....	.....	.....	
95,840	1,000	.0264	.....	0.	0.	
1,917	20	.....	.0002	.....	.....	
115,008	1,200	.0316	.....	.....	.....	
134,176	1,400	.0367	.....	.....	.....	
153,344	1,600	.0418	.....	.....	.....	
172,512	1,800	.0471	.....	.....	.....	
191,680	2,000	.0525	.....	0.	0.	
1,917	20	.....	.0003	.....	.....	
210,848	2,200	.0577	.....	.....	.....	
230,016	2,400	.0630	.....	.....	.....	
249,184	2,600	.0685	.....	0.	0.	
268,352	2,800	.0739	.....	— .01	0.	
287,520	3,000	.0802	.....	— .01	0.	
1,917	20	.....	.0008	.....	.....	
306,688	3,200	.0857	.....	— .01	0.	
325,856	3,400	.0930	.....	— .02	0.	
345,024	3,600	.1045	.....	— .07	0.	
356,000	3,714	.....	.....	.....	.....	Ultimate strength.

Fibers crushed at a knot 10" from the upper end of the post.

No. 9170.

LONG-LEAF PINE.

Post from top of tree.
Length, 118".65.
Weight, 284 pounds = 43.3 pounds per cubic foot.
Counterweight at middle, 142 pounds.
Average rate of growth, 8 rings per inch.
Sectional area, 9".76 × 9".79 = 95.55 square inches.
Gauged length, 50".
Taken from same 30-foot stick as Nos. 9168 and 9169.
Post contains 8 knots from 1" to 2" diameter.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,911	20	0.	0.	0.	0.	Initial load.
9,555	100	.0014				
19,110	200	.0038				
28,665	300	.0062				
38,220	400	.0090				
47,775	500	.0117		0.	0.	
1,911	20		0.			
57,330	600	.0145				
66,885	700	.0173				
76,440	800	.0202				
85,995	900	.0229				
95,550	1,000	.0260		0.	0.	
1,911	20		0.			
114,660	1,200	.0315				
133,770	1,400	.0376				
152,880	1,600	.0441				
171,990	1,800	.0504				
191,100	2,000	.0568		0.	0.	
1,911	20		.0002			
210,210	2,200	.0631				
229,320	2,400	.0697				
248,430	2,600	.0763				
267,540	2,800	.0833				
286,650	3,000	.0910		0.	0.	
1,911	20		.0012			
305,760	3,200	.1004		.02	0.	
323,350	3,384	.1197		.05	0.	Ultimate strength.

Fibers crushed at a knot, $1\frac{1}{8}$" diameter, 32" from the upper end of the post.

No. 9171.

LONG-LEAF PINE.

Post from top of tree.
Length, 120″.08.
Weight, 267 pounds = 40.4 pounds per cubic foot.
Counterweight at middle, 234 pounds.
Average rate of growth, 13 rings per inch.
Sectional area, 9″.73 × 9″.76 = 94.96 square inches.
Gauged length, 50″.
About 5 per cent of this stick is sap wood.
Post contains 2 knots, 2″ diameter each.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,899	20	0.	0.	0.	0.	Initial load.
9,496	100	.0015	.....	.....	.....	
18,992	200	.0045	.....	.....	.....	
28,488	300	.0077	.....	.....	.....	
37,984	400	.0108	.....	.....	.....	
47,480	500	.0140	.....	0.	0.	
1,899	20	.....	0.	.....	.....	
56,976	600	.0171	.....	.....	.....	
66,472	700	.0203	.....	.....	.....	
75,968	800	.0235	.....	0.	.01	
85,464	900	.0268	.....	.....	.....	
94,960	1,000	.0300	.....	0.	.01	
1,899	20	.....	0.	.....	.....	
113,952	1,200	.0361	.....	— .01	.02	
132,944	1,400	.0428	.....	— .02	.03	
151,936	1,600	.0494	.....	— .03	.05	
170,928	1,800	.0560	.....	— .04	.06	
189,920	2,000	.0627	.....	— .05	.07	
1,899	20	.....	.0001	.....	.....	
208,912	2,200	.0695	.....	— .06	.08	
227,904	2,400	.0767	.....	— .08	.09	
246,896	2,600	.0837	.....	— .09	.10	
265,888	2,800	.0910	.....	— .10	.10	
284,880	3,000	.0990	.....	— .10	.11	
1,899	20	.....	.0013	.....	.....	
303,872	3,200	.1067	.....	— .11	.11	
320,000	3,369	.....	.....	.....	.....	Ultimate strength.

Fibers crushed at a knot, 4 feet 3 inches from the upper end of post.

No. 9172.

LONG-LEAF PINE.

Post from top of tree.
Length, 119″.88.
Weight, 284 pounds = 43 pounds per cubic foot.
Counterweight at middle, 142 pounds.
Average rate of growth, 15 rings per inch.
Sectional area, 9″.75 × 9″.77 = 95.26 square inches.
Gauged length, 50″.
Post contains 3 knots from $\frac{1}{2}$″ to $\frac{3}{4}$″ diameter.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,905	20	0.	0.	0.	0.	Initial load.
9,526	100	.0011				
19,052	200	.0034				
28,578	300	.0061				
38,104	400	.0089				
47,630	500	.0118		0.	0.	
1,905	20		.0001			
57,156	600	.0146				
66,682	700	.0176				
76,208	800	.0206				
85,734	900	.0236				
95,260	1,000	.0266		0.	0.	
1,905	20		0.			
114,312	1,200	.0325				
133,364	1,400	.0386				
152,416	1,600	.0449				
171,468	1,800	.0509				
190,520	2,000	.0572		0.	0.	
1,905	20		0.			
209,572	2,200	.0634				
228,624	2,400	.0700				
247,676	2,600	.0766				
266,728	2,800	.0834				
285,780	3,000	.0907		0.	0.	
1,905	20		.0006			
266,728	2,800					Post rested under this load 40 hours.
304,832	3,200	.0987				
323,884	3,400	.1085				
342,936	3,600	.1264				Ultimate strength.

Fibers crushed 2″ and 5″ from the end of the post, in the vicinity of small knots.

No. 9173.

LONG-LEAF PINE.

Post from butt of tree.
Length, 120".04.
Weight, 302 pounds = 45.6 pounds per cubic foot.
Counterweight at middle, 151 pounds.
Average rate of growth, 13 rings per inch.
Sectional area, 9".75 × 9".77 = 95.26 square inches.
Gauged length, 50".
Post free from knots.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,905	20	0.	0.	0.	0.	Initial load.
9,526	100	.0016				
19,052	200	.0039				
28,578	300	.0062				
38,104	400	.0086				
47,630	500	.0111		0.	0.	
1,905	20		0.			
57,156	600	.0136				
66,682	700	.0160				
76,208	800	.0186				
85,734	900	.0210				
95,260	1,000	.0235		0.	0.	
1,905	20		.0002			
114,312	1,200	.0285				
133,364	1,400	.0335				
152,416	1,600	.0384				
171,468	1,800	.0438				
190,520	2,000	.0490		0.	0.	
1,905	20		.0005			
209,572	2,200	.0541				
228,624	2,400	.0596				
247,676	2,600	.0647				
266,728	2,800	.0700				
285,780	3,000	.0753		0.	0.	
1,905	20		.0009			
304,832	3,200	.0806				
323,884	3,400	.0864				
342,936	3,600	.0927				
361,988	3,800	.1000				
381,040	4,000	.1072		0.	0.	
1,905	20		.0019			
400,092	4,200	.1079		— .01	0.	
416,000	4.367					Ultimate strength.

Fibers crushed at end of post.

No. 9174.

LONG-LEAF PINE.

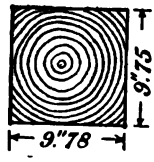
Post from butt of tree.
Length, 119".95.
Weight, 329 pounds = 49. 9 pounds per cubic foot.
Counterweight at middle, 164 pounds.
Average rate of growth, 16 rings per inch.
Sectional area, 9".74 × 9".74 = 94.87 square inches.
Gauged length, 50".
Post contains 5 knots, $\frac{1}{8}$" to $\frac{3}{4}$" diameter.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1, 897	20	0.	0.	0.	0.	Initial load.
9, 487	100	.0026				
18, 974	200	.0050				
28, 461	300	.0075				
37, 948	400	.0097				
47, 435	500	.0121		0.	0.	
1. 897	20		.0001			
56, 922	600	.0142				
66, 409	700	.0165				
75, 896	800	.0186				
85, 383	900	.0208				
94, 870	1, 000	.0230		0.	0.	
1, 897	20		.0003			
113, 844	1, 200	.0271				
132, 818	1, 400	.0317				
151, 792	1, 600	.0361				
170, 766	1, 800	.0406		.01	0.	
189, 740	2, 000	.0451		.01	0.	
1, 897	20		.0009			
208, 714	2, 200	.0496		.02	0.	
227, 688	2, 400	.0544				
246, 662	2, 600	.0589				
265, 636	2, 800	.0633				
284, 610	3, 000	.0681		.02	0.	
1, 897	20		.0014			
303, 584	3, 200	.0726				
322, 558	3, 400	.0774				
341, 532	3, 600	.0823		.03	0.	
360, 506	3, 800	.0873				
379, 480	4, 000	.0925		.04	0.	
1, 897	20		.0026			
398, 454	4, 200	.0982				
417, 428	4, 400	.1039				
436, 402	4, 600	.1095		.05	.01	
448, 500	4, 727					Ultimate strength.

Fibers crushed at a knot $\frac{5}{8}$" diameter, 15" from end of post.

No. 9175.

LONG-LEAF PINE.



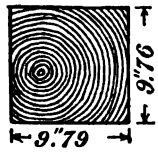
Post from top of tree.
Length, 120".10.
Weight, 279 pounds = 42.1 pounds per cubic foot.
Counterweight at middle, 140 pounds.
Average rate of growth, 11 rings per inch.
Sectional area, 9".75 × 9".78 = 95.35 square inches.
Gauged length, 50".
Post contains 13 knots ½" to 2" diameter.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,917	20	0.	0.	0.	0.	Initial load.
9,535	100	.0018	.....	.....	.....	
19,070	200	.0041	.....	.....	.....	
28,605	300	.0066	.....	.....	.....	
38,140	400	.0093	.....	.....	.....	
47,675	500	.0120	.....	0.	0.	
1,917	20	.....	0.	.....	.....	
57,210	600	.0146	.....	.....	.....	
66,745	700	.0176	.....	.....	.....	
76,280	800	.0205	.....	.....	.....	
85,815	900	.0235	.....	.....	.....	
95,350	1,000	.0265	.....	0.	0.	
1,917	20	.....	.0003	.....	.....	
114,420	1,200	.0329	.....	.....	.....	
133,490	1,400	.0396	.....	.....	.....	
152,560	1,600	.0461	.....	.....	.....	
171,630	1,800	.0529	.....	.....	.....	
190,700	2,000	.0596	.....	0.	0.	
1,917	20	.....	.0017	.....	.....	
209,770	2,200	.0668	.....	.....	.....	
228,840	2,400	.0738	.....	.....	.....	
247,910	2,600	.0801	.....	.....	.....	
266,980	2,800	.0873	.....	.....	.....	
286,050	3,000	.0952	.....	0.	0.	
1,917	20	.....	.0036	.....	.....	
305,120	3,200	.1040	.....	0.	.01	
324,190	3,400	.1145	.....	— .01	.03	
337,100	3,535	.1235	.....	— .05	.10	Ultimate strength.

Failed at knots near middle of length of post.

No. 9176.

LONG-LEAF PINE.



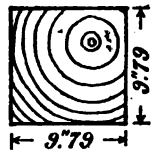
Post from butt of tree.
Length, 119".97.
Weight, 354 pounds = 53.4 pounds per cubic foot.
Counterweight at middle, 177 pounds.
Average rate of growth, 22 rings per inch.
Sectional area, 9".76 × 9".79 = 95.55 square inches.
Gauged length, 50".
Post free from knots.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,911	20	0.	0.	0.	0.	Initial load.
9,555	100	.0017	.....	.....	.....	
19,110	200	.0038	.....	.....	.....	
28,665	300	.0059	.....	.....	.....	
38,220	400	.0079	.....	.....	.....	
47,775	500	.0098	.....	0.	0.	
1,911	20	.....	0.	.....	.....	
57,330	600	.0118	.....	.....	.....	
66,885	700	.0139	.....	.....	.....	
76,440	800	.0159	.....	.....	.....	
85,995	900	.0180	.....	.....	.....	
95,550	1,000	.0200	.....	0.	0.	
1,911	20	.....	.0002	.....	.....	
114,660	1,200	.0240	.....	.....	.....	
133,770	1,400	.0281	.....	.....	.....	
152,880	1,600	.0324	.....	.....	.....	
171,990	1,800	.0366	.....	.....	.....	
191,100	2,000	.0409	.....	0.	0.	
1,911	20	.....	.0005	.....	.....	
210,210	2,200	.0453	.....	.....	.....	
229,320	2,400	.0496	.....	.....	.....	
248,430	2,600	.0540	.....	.....	.....	
267,540	2,800	.0583	.....	.....	.....	
286,650	3,000	.0628	.....	0.	0.	
1,911	20	.....	.0007	.....	.....	
305,760	3,200	.0675	.....	.....	.....	
324,870	3,400	.0721	.....	.....	.....	
343,980	3,600	.0767	.....	.....	.....	
363,090	3,800	.0816	.....	.....	.....	
382,200	4,000	.0861	.....	0.	0.	
1,911	20	.....	.0012	.....	.....	
401,310	4,200	.0918	.....	.....	.....	
420,420	4,400	.0971	.....	.....	.....	
439,530	4,600	.1040	.....	.....	.....	
458,640	4,800	.1125	.....	.01	0.	
475,500	4,976	.....	.....	.....	.....	Ultimate strength.

Fibers crushed 3 feet from end of post.

No. 9197.

SHORT LEAF PINE.



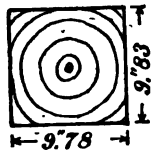
Post from middle of tree.
Length, 120".07.
Weight, 274 pounds = 41.1 pounds per cubic foot.
Counter weight at middle, 137 pounds.
Average rate of growth, 3 to 3½ rings per inch.
Sectional area, 9".79 × 9".79 = 95.84 square inches.
Gauged length, 50".
Taken from same tree as posts Nos. 9198 and 9199.
Post contains 10 knots, ½" to 1½" diameter.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,916	20	0.	0.	0.	0.	Initial load.
9,584	100	.0030	.....	.....	.....	
19,168	200	.0064	.....	.....	.....	
28,752	300	.0098	.....	.....	.....	
38,336	400	.0132	.....	.....	.....	
47,920	500	.0165	.....	0.	0.	
1,916	20	.....	.0004	.....	.....	
57,504	600	.0200	.....	.....	.....	
67,088	700	.0234	.....	0.	.01	
76,672	800	.0273	.....	.....	.....	
86,256	900	.0307	.....	.....	.....	
95,840	1,000	.0343	.....	0.	.01	
1,916	20	.....	.0006	.....	.....	
115,008	1,200	.0417	.....	.....	.....	
134,176	1,400	.0498	.....	.....	.....	
153,344	1,600	.0578	.....	.....	.....	
172,512	1,800	.0662	.....	.....	.....	
191,680	2,000	.0745	.....	0.	.01	
1,916	20	.....	.0010	.....	.....	
210,848	2,200	.0832	.....	.....	.....	
230,016	2,400	.0924	.....	.....	.....	
249,184	2,600	.1025	.....	.....	.....	
268,352	2,800	.1135	.....	.....	.....	
287,520	3,000	.1283	.....	0.	.01	
1,916	20	.....	.0041	.....	.....	
300,500	3,135	.1439	.....	.....	.....	Ultimate strength.

Fibers crushed at knots 22" from end of post.

No. 9198.

SHORT LEAF PINE.



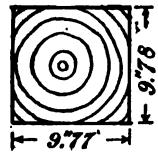
Post from top of tree.
Length, 120″.
Weight, 256 pounds = 38.3 pounds per cubic foot.
Counter weight at middle, 128 pounds.
Average rate of growth, 3 rings per inch.
Sectional area, 9″.78 × 9″.83 = 96.14 square inches.
Gauged length, 50″.
Taken from same tree as posts Nos. 9197 and 9199.
Post contains 18 knots, 1″ to 2″ diameter.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,922	20	0.	0.	0.	0.	Initial load.
9,614	100	.0015	.....	.....	.....	
19,228	200	.0044	.....	.....	.....	
28,842	300	.0076	.....	.....	.....	
38,456	400	.0110	.....	.....	.....	
48,070	500	.0145	.....	0.	0.	
1,922	20	.....	0.	.....	.....	
57,684	600	.0180	.....	.....	.....	
67,298	700	.0215	.....	.....	.....	
76,912	800	.0251	.....	.....	.....	
86,526	900	.0290	.....	.....	.....	
96,140	1,000	.0325	.....	0.	0.	
1,922	20	.....	.0002	.....	.....	
115,368	1,200	.0396	.....	.....	.....	
134,596	1,400	.0474	.....	.....	.....	
153,824	1,600	.0552	.....	.....	.....	
173,052	1,800	.0631	.....	.....	.....	
192,280	2,000	.0717	.....	0.	0.	
1,922	20	.....	.0007	.....	.....	
211,508	2,200	.0809	.....	.....	.....	
230,736	2,400	.0910	.....	.01	0.	
249,964	2,600	.1045	.....	.07	0.	Ultimate strength.

Fibers crushed at a 2″ knot 16″ from the lower end of the post.

No. 9199.

SHORT-LEAF PINE.



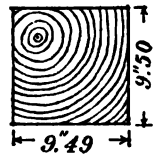
Post from butt of tree.
Length, 120″.
Weight, 278 pounds = 41.9 pounds per cubic foot.
Counter weight at middle, 139 pounds.
Average rate of growth, 2½ to 2¾ rings per inch.
Sectional area, 9″.77 × 9″.78 = 95.55 square inches.
Gauged length, 50″.
Taken from same tree as posts Nos. 9197 and 9198.
Post contains 8 knots ¼″ to ¾″ diameter.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,911	20	0.	0.	0.	0.	Initial load.
9,555	100	.0031				
19,110	200	.0066				
28,665	300	.0103				
38,220	400	.0138				
47,775	500	.0174		0.	0.	
1,911	20		.0004			
57,330	600	.0210				
66,885	700	.0245				
76,440	800	.0281				
85,995	900	.0317				
95,550	1,000	.0353		0.	0.	
1,911	20		.0008			
114,660	1,200	.0429				
133,770	1,400	.0506				
152,880	1,600	.0583				
171,990	1,800	.0662				
191,100	2,000	.0745		0.	0.	
1,911	20		.0013			
210,210	2,200	.0829				
229,320	2,400	.0919				
248,430	2,600	.1021				
267,540	2,800	.1185		— .02	— .03	
286,650	3,000	.1453		— .08	— .12	
1,911	20		.0060	0.	0.	
290,200	3,037					Ultimate strength.

Fibers crushed in an oblique line from end of post along 20″ of its length.

No. 9200.

SHORT-LEAF PINE.



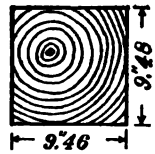
Post from middle of tree.
Length, 120".03.
Weight, 307 pounds = 49 pounds per cubic foot.
Counter weight at middle, 153 pounds.
Average rate of growth, 9 to 10 rings per inch.
Sectional area, 9".49 × 9".50 = 90.15 square inches.
Gauged length, 50".
Taken from same stick as posts Nos. 9201 and 9202.
Post contains no knots; 15 per cent of stick sap wood.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,803	20	0.	0.	0.	0.	Initial load.
9,015	100	.0015	.....	.....	.....	
18,030	200	.0039	.....	.....	.....	
27,045	300	.0064	.....	.....	.....	
36,060	400	.0089	.....	.....	.....	
45,075	500	.0114	.....	0.	0.	
1,803	20	.....	0.	.....	.....	
54,090	600	.0139	.....	.....	.....	
63,105	700	.0166	.....	.....	.....	
72,120	800	.0191	.....	.....	.....	
81,135	900	.0215	.....	.....	.....	
90,150	1,000	.0242	.....	0.	0.	
1,803	20	.....	0.	.....	.....	
108,180	1,200	.0295	.....	0.	.01	
126,210	1,400	.0349	.....	.....	.....	
144,240	1,600	.0402	.....	.....	.....	
162,270	1,800	.0458	.....	.....	.....	
180,300	2,000	.0513	.....	0.	.01	
1,803	20	.....	.0003	.....	.....	
198,330	2,200	.0568	.....	.....	.....	
216,360	2,400	.0625	.....	0.	.02	
234,390	2,600	.0682	.....	.....	.....	
252,420	2,800	.0739	.....	.01	.02	
270,450	3,000	.0800	.....	.01	.02	
1,803	20	.....	.0008	.....	.....	
288,480	3,200	.0860	.....	.....	.....	
306,510	3,400	.0926	.....	.01	04	
324,540	3,600	.0990	.....	.01	.08	
342,570	3,800	.1051	.....	.01	.10	
360,600	4,000	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure, bending upward at the middle. Sap wood on the side of the post parallel to the direction of the deflection.

No. 9201.

SHORT-LEAF PINE.



Post from butt of tree.
Length, 120″.06.
Weight, 313 pounds = 50.2 pounds per cubic foot.
Counterweight at middle, 157 pounds.
Average rate of growth, 11 rings per inch.
Sectional area, 9″.46 × 9″.48 = 89.68 square inches.
Gauged length, 50″.
Taken from same stick as posts Nos. 9200 and 9202.
Post contains no knots.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,793	20	0.	0.	0.	0.	Initial load.
8,968	100	.0020	.....	.....	.....	
17,936	200	.0045	.....	.....	.....	
26,904	300	.0072	.....	.....	.....	
35,872	400	.0099	.....	.....	.....	
44,840	500	.0125	.....	0.	0.	
1,793	20	.....	.0002	.....	.....	
53,808	600	.0150	.....	.....	.....	
62,776	700	.0177	.....	.....	.....	
71,744	800	.0202	.....	.....	.....	
80,712	900	.0228	.....	.....	.....	
89,680	1,000	.0254	.....	0.	0.	
1,793	20	.....	.0004	.....	.....	
107,616	1,200	.0308	.....	.....	.....	
125,552	1,400	.0361	.....	.....	.....	
143,488	1,600	.0417	.....	.....	.....	
161,424	1,800	.0475	.....	.....	.....	
179,360	2,000	.0530	.....	0.	0.	
1,793	20	.....	.0006	.....	.....	
197,296	2,200	.0591	.....	.....	.....	
215,232	2,400	.0650	.....	.....	.....	
233,168	2,600	.0712	.....	.01	0.	
251,104	2,800	.0770	.....	.....	.....	
269,040	3,000	.0834	.....	.02	0.	
1,793	20	.....	.0013	.....	.....	
286,976	3,200	.0899	.....	.....	.....	
304,912	3,400	.0972	.....	.03	0.	
322,848	3,600	.1050	.....	.04	0.	
340,784	3,800	.1153	.....	.07	— .03	
352,000	3,925	.....	.....	.....	.....	Ultimate strength.

Fibers crushed near the end of the post.

No. 9202.

SHORT-LEAF PINE.

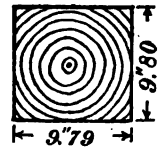
Post from top of tree.
Length, 119.″98.
Weight, 296 pounds = 47.3 pounds per cubic foot.
Counterweight at middle, 148 pounds.
Average rate of growth, 8 rings per inch.
Sectional area, 9.″49 × 9.″50 = 90.15 square inches.
Gauged length, 50″.
Taken from same stick as posts Nos. 9200 and 9201.
Post contains 3 knots, ½″ to 2″ diameter; 20 per cent sapwood along the corners.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch*	*Inch.*	
1,803	20	0.	0.	0.	0.	Initial load.
9,015	100	.0024	.....	.....	.....	
18,030	200	.0056	.....	.....	.....	
27,045	300	.0088	.....	.....	.....	
36,060	400	.0123	.....	.....	.....	
45,075	500	.0156	.....	0.	0.	
1,803	20	.....	0.	.....	.....	
54,090	600	.0189	.....	.....	.....	
63,105	700	.0223	.....	.....	.....	
72,120	800	.0256	.....	0.	.01	
81,135	900	.0292	.....	.....	.....	
90,150	1,000	.0326	.....	0.	.02	
1,803	20	.....	.0002	.....	.....	
108,180	1,200	.0396	.....	.....	.....	
126,210	1,400	.0467	.....	.....	.....	
144,240	1,600	.0543	.....	.....	.....	
162,270	1,800	.0618	.....	0.	.03	
180,300	2,000	.0692	.....	0.	.03	
1,803	20	.....	.0008	.....	.....	
198,330	2,200	.0765	.....	— .01	.03	
216,360	2,400	.0844	.....	— .02	.04	
234,390	2,600	.0948	.....	— .02	.05	
252,420	2,800	.1012	.....	— .03	.05	
270,450	3,000	.1098	.....	— .03	.07	
1,803	20	.....	.0019	0.	0.	
288,480	3,200	.1198	.....	— .05	.09	
306,510	3,400	.1317	.....	— .10	.10	Ultimate strength.

Fibers crushed, taking an oblique direction 2″ to 10″ from end of post.

No. 9203.

LONG LEAF PINE.



Post from middle of height of tree. Stick from yard.
Length, 120".06.
Weight, 282 pounds = 42.3 pounds per cubic foot.
Counter weight at middle, 141 pounds.
Average rate of growth, 6¾ rings per inch.
Sectional area, 9".79 × 9".80 = 95.94 square inches.
Gauged length, 50".
Taken from same stick as posts Nos. 9204 and 9208.
Post contains 6 knots ⅜" to 1½" diameter.

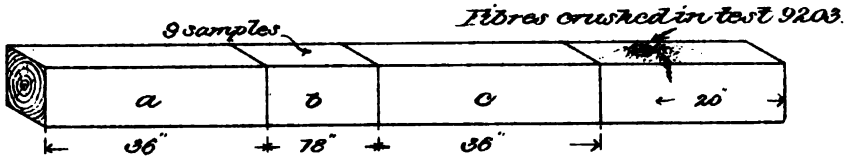
Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,919	20	0.	0.	0.	0.	Initial load.
9,594	100	.0024	.....	.....	.....	
19,188	200	.0052	.....	.....	.....	
28,782	300	.0081	.....	.....	.....	
38,376	400	.0110	.....	.....	.....	
47,970	500	.0140	.....	0.	0.	
1,919	20	.....	0.	.....	.....	
57,564	600	.0167	.....	.....	.....	
67,158	700	.0197	.....	.....	.....	
76,752	800	.0225	.....	.....	.....	
86,346	900	.0254	.....	.....	.....	
95,940	1,000	.0283	.....	0.	0.	
1,919	20	.....	.0001	.....	.....	
115,128	1,200	.0340	.....	.....	.....	
134,316	1,400	.0400	.....	.....	.....	
153,504	1,600	.0460	.....	.....	.....	
172,692	1,800	.0519	.....	.....	.....	
191,880	2,000	.0580	.....	0.	0.	
1,919	20	.....	.0004	.....	.....	
211,068	2,200	.0640	.....	.01	0.	
230,256	2,400	.0703	.....	.....	.....	
249,444	2,600	.0762	.....	.....	.....	
268,632	2,800	.0824	.....	.....	.....	
287,820	3,000	.0884	.....	.02	0.	
1,919	20	.....	.0008	0.	0.	
307,008	3,200	.0943	.....	.....	.....	
326,196	3,400	.1009	.....	.....	.....	
345,384	3,600	.1074	.....	.....	.....	
364,572	3,800	.1148	.....	.03	0.	
383,760	4,000	.1219	.....	.03	0.	
1,919	20	.....	.0020	0.	0.	
402,948	4,200	.1314	.....	.04	.02	Ultimate strength.

Fibers crushed at an 1¼" knot 20" from the end of post.

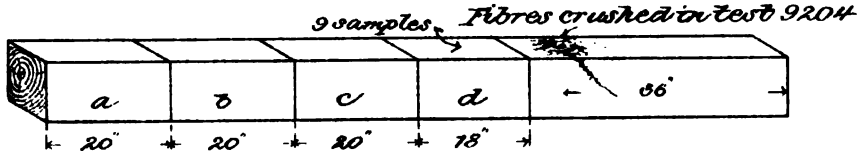
Short specimens.

Location in original sticks.

No. 9203.



No. 9204.



End view of sections 9203 b, and 9204 d.

I	II	III
IV	V	VI
VII	VIII	IX

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

COMPRESSION TESTS OF SHORT SPECIMENS CUT FROM POST 9203.

No. of test.	Description.	Dimensions.			Sectional area.	Ultimate strength.	
		Length.	Compressed surface.			Total.	Per square inch.
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*
9203 *a* ..	Clear stock	36.08	9.80	9.79	95.94	449,800	4,688
9203 *c* ..	3 knots, ".6 to ".75 diameter.	35.93	9.80	9.79	95.94	416,400	4,340

SMALL SPECIMENS FROM SECTION *b*.

9203 *b* .	I. 1 knot, ".60 diameter.....	17.87	3.16	3.14	9.22	42,310	4,589
	II. 1 knot, ".80 diameter....	17.87	3.15	3.27	10.30	46,240	4,489
	III. No knots.....	17.87	3.14	3.14	9.86	45,400	4,604
	IV. No knots.....	17.87	3.14	3.23	10.14	44,100	4,349
	V. 2 knots, ".60 and ".80 diameter.....	17.87	3.21	3.24	10.40	36,350	3,495
	VI. 1 knot ".75 diameter....	17.87	3.12	3.25	10.14	43,510	4,291
	VII. No knots.....	17.87	3.11	3.15	9.80	47,710	4,868
	VIII. No knots.....	17.87	3.16	3.27	10.33	47,090	4,558
	IX. No knots.....	17.87	3.13	3.12	9.77	48,030	4,916

Specimens III and IX crushed at places along the length where a cant hook had made holes in the wood.

No. 9204.

LONG LEAF PINE.

Post from the top of tree. Stick from yard.
Length, 120″.02.
Weight, 269½ pounds = 40.3 pounds per cubic foot.
Counter weight at middle, 135 pounds.
Average rate of growth, 8 rings per inch.
Sectional area, 9″.79 × 9″.82 = 96.14 square inches.
Gauged length, 50″.
Taken from same stick as posts Nos. 9203 and 9208.
Post contains 8 knots ⅜″ to 2½″ diameter.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,923	20	0.	0.	0.	0.	Initial load.
9,614	100	.0020				
19,228	200	.0048				
28,842	300	.0077				
38,456	400	.0107				
48,070	500	.0139		0.	0.	
1,923	20		0.			
57,684	600	.0170				
67,298	700	.0201				
76,912	800	.0233				
86,526	900	.0265		.01	0.	
96,140	1,000	.0296		.01	0.	
1,923	20		.0001			
115,368	1,200	.0360				
134,596	1,400	.0427				
153,824	1,600	.0492		.02	0.	
173,052	1,800	.0558				
192,280	2,000	.0625		.02	0.	
1,923	20		.0005	0.	0.	
211,508	2,200	.0692		.03	0.	
230,736	2,400	.0760		.04	0.	
249,964	2,600	.0829				
269,192	2,800	.0895				
288,420	3,000	.0965		.05	0.	
1,923	20		.0011	0.	0.	
307,648	3,200	.1032				
326,876	3,400	.1102				
346,104	3,600	.1181		.06	— .02	
365,332	3,800	.1258		.08	— .05	Ultimate strength.

Fibers crushed at large knot 36″ from the end of post.

COMPRESSION TESTS OF SHORT SPECIMENS CUT FROM POST 9204.

No. of test.	Description.	Dimensions.			Sectional area.	Ultimate strength.	
		Length.	Compressed surface.			Total.	Per square inch.
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*
9204 *a* ..	2 knots, $\frac{3}{4}$" and 1$\frac{1}{4}$" diameter.	19.89	9.82	9.79	96.14	396,600	4,125
9204 *b* ..	1 knot, 1" diameter.....	19.95	9.82	9.79	96.14	409,400	4,258
9204 *c* ..	2 knots, 1" and 2$\frac{1}{2}$" diameter.	19.92	9.82	9.79	96.14	389,900	4,055

SMALL SPECIMENS FROM SECTION *d*.

9204 *d* .	I. No knots	17.89	3.17	3.18	10.08	45,200	4,484
	II. No knots.....	17.89	3.18	3.17	10.08	45,870	4,551
	III. No knots.....	17.89	3.18	3.18	10.11	47,220	4,671
	IV. No knots	17.89	3.16	3.20	10.24	43,060	4,205
	V. No knots	9.90	3.19	3.14	10.02	35,600	3,553
	V$_1$. 1 knot, ".90 diameter....	7.83	3.19	3.14	10.02	33,140	3,307
	VI. No knots	17.89	3.20	3.18	10.18	45,700	4,489
	VII. No knots	17.89	3.19	3.19	10.18	39,380	3,868
	VIII. No knots	9.98	3.20	3.16	10.11	42,640	4,218
	VIII$_1$. 1 knot, ".80 diameter.	7.78	3.20	3.16	10.11	41,120	4,067
	IX. No knots	9.98	3.20	3.19	10.21	44,500	4,358
	IX$_1$. 1 knot, ".80 diameter ..	7.78	3.20	3.19	10.21	41,710	4,085

No. 9208.

LONG-LEAF PINE.

Post from butt of tree. Stick from yard.
Length, 119".96.
Weight, 315 pounds = 47.4 pounds per cubic foot.
Counterweight at middle, 157 pounds.
Average rate of growth, 8 to 8$\frac{1}{2}$ rings per inch.
Sectional area, 9".77 × 9".79 = 95.65 square inches.
Gauged length, 50".
Taken from same stick as posts Nos. 9203 and 9204.
Post contains no knots in sight.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,913	20	0.	0.	0.	0.	Initial load.
9,565	100	.0013	.....	.....	.....	
19,130	200	.0034	.....	.....	.....	
28,695	300	.0059	.....	.....	.....	
38,260	400	.0082	.....	.....	.....	
47,825	500	.0109	.....	0.	0.	
1,913	20	.....	0.	.....	.....	
57,390	600	.0135	.....	.....	.....	

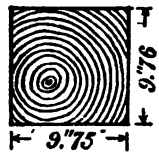
No. 9208—Continued.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
66,955	700	.0161	.....	.....	.....	
76,520	800	.0186	.....	.....	.....	
86,085	900	.0213	.....	.....	.....	
95,650	1,000	.0239	.....	.01	0.	
1,913	20	.....	.0002	0.	0.	
114,780	1,200	.0291	.....	.....	.....	
133,910	1,400	.0345	.....	.02	0.	
153,040	1,600	.0402	.....	.03	0.	
172,170	1,800	.0455	.....	.....	.....	
191,300	2,000	.0512	.....	.03	0.	
1,913	20	.....	.0004	0.	0.	
210,430	2,200	.0567	.....	.....	.....	
229,560	2,400	.0625	.....	.....	.....	
248,690	2,600	.0684	.....	.04	0.	
267,820	2,800	.0739	.....	.....	.....	
286,950	3,000	.0798	.....	.04	0.	
1,913	20	.....	.0006	0.	0.	
286,950	3,000	.0797	.....	.04	0.	
.....	3,000	.0804	.....	.....	.....	After 5 minutes.
.....	3,000	.0805	.....	.05	0.	After 10 minutes.
.....	3,000	.0806	.....	.....	.....	After 15 minutes.
.....	3,000	.0807	.....	.....	.....	After 20 minutes.
.....	3,000	.0808	.....	.....	.....	After 25 minutes.
.....	3,000	.0809	.....	.....	.....	After 30 minutes.
.....	3,000	.0810	.....	.....	.....	After 40 minutes.
.....	3,000	.0810	.....	.....	.....	After 1 hour.
306,080	3,200	.0863	.....	.05	0.	
.....	3,200	.0866	.....	.....	.....	After 5 minutes.
.....	3,200	.0867	.....	.....	.....	After 10 minutes.
.....	3,200	.0868	.....	.....	.....	After 20 minutes.
.....	3,200	.0869	.....	.....	.....	After 30 minutes.
306,080	3,200	.....	.....	.....	.....	Load left on post Saturday night.
292,600	3,059	.....	.....	.....	.....	Load on post Monday morning, after 40 hours.
306,080	3,200	.0890	.....	.07	0.	
.....	3,200	.0890	.....	.....	.....	After 20 minutes.
325,210	3,400	.0944	.....	.07	0.	
.....	3,400	.0945	.....	.....	.....	After 5 minutes.
344,340	3,600	.0996	.....	.....	.....	
.....	3,600	.0998	.....	.....	.....	After 5 minutes.
363,470	3,800	.1052	.....	.....	.....	
.....	3,800	.1058	.....	.....	.....	After 5 minutes.
382,600	4,000	.....	.....	.....	.....	
.....	4,000	.1118	.....	.....	.....	After 5 minutes.
.....	4,000	.1120	.....	.....	.....	After 10 minutes.
401,730	4,200	.1175	.....	.08	0.	
.....	4,200	.1183	.....	.....	.....	After 5 minutes.
420,860	4,400	.1235	.....	.09	0.	
.....	4,400	.1240	.....	.....	.....	After 5 minutes.
439,990	4,600	.1320	.....	.10	0.	Ultimate strength.

Fibers crushed 30″ from end of post. Cutting the post apart, there was found a sound knot near the center $\frac{3}{4}$″ diameter.

No. 9177.

SPRUCE POST.



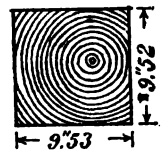
Length, 119″.88.
Weight, 198 pounds = 30 pounds per cubic foot.
Counterweight at middle, 100 pounds.
Average rate of growth, 13 rings per inch.
Sectional area, 9″.75 × 9″.76 = 95.16 square inches.
Gauged length, 50″.
Post contains 46 knots $\frac{3}{8}$″ to $1\frac{3}{4}$″ diameter.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,903	20	0.	0.	0.	0.	Initial load.
9,516	100	.0029	.....	.....	.....	
19,032	200	.0070	.....	.....	.....	
28,548	300	.0108	.....	.01	0.	
38,064	400	.0148	.....	.01	0.	
47,580	500	.0188	.....	.02	0.	
1,903	20	.....	.0003	.....	.....	
57,096	600	.0230	.....	.02	0.	
66,612	700	.0270	.....	.03	0.	
76,128	800	.0311	.....	.03	0.	
85,644	900	.0352	.....	.03	0.	
95,160	1,000	.0392	.....	.03	0.	
1,903	20	.....	.0008	.....	.....	
104,676	1,100	.0432	.....	.03	0.	
114,192	1,200	.0475	.....	.03	0.	
123,708	1,300	.0518	.....	.04	0.	
133,224	1,400	.0558	.....	.04	0.	
142,740	1,500	.0602	.....	.04	0.	
1,903	20	.....	.0012	.....	.....	
152,256	1,600	.0644	.....	.04	0.	
161,772	1,700	.0690	.....	.05	0.	
171,288	1,800	.0735	.....	.05	0.	
180,804	1,900	.0788	.....	.05	0.	
190,320	2,000	.0844	.....	.06	0.	
1,903	20	.....	.0025	.....	.....	
209,352	2,200	.0998	.....	.07	— .01	
216,800	2,278	.....	.....	.....	.....	Ultimate strength.

Fibers crushed at group of knots 27″ from the end of the post.

No. 9188.

SPRUCE POST.



Length, 119".26.
Weight, 212 pounds = 33.8 pounds per cubic foot.
Counterweight at middle, 106 pounds.
Average rate of growth, 20 rings per inch.
Sectional area, 9".52 × 9".53 = 90.72 square inches.
Gauged length, 50".
Post taken from same stick as No. 9190.
Post contains 47 knots, $\frac{1}{8}$" to $1\frac{1}{2}$" diameter.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,814	20	0.	0.	0.	0.	Initial load.
9,072	100	.0024				
18,144	200	.0054				
27,216	300	.0084				
36,288	400	.0115				
45,360	500	.0148		0.	0.	
1,814	20		0.			
54,432	600	.0178				
63,504	700	.0209				
72,576	800	.0239				
81,648	900	.0272				
90,720	1,000	.0304		0.	0.	
1,814	20		.0003			
99,792	1,100	.0336				
108,864	1,200	.0367				
117,936	1,300	.0400				
127,008	1,400	.0434		0.	.01	
136,080	1,500	.0471		0.	.01	
1,814	20		.0009			
145,152	1,600	.0502		0.	.01	
154,224	1,700	.0536		0.	.01	
163,296	1,800	.0570		0.	.01	
172,368	1,900	.0603		0.	.01	
181,440	2,000	.0638		0.	.01	
1,814	20		.0010			
190,512	2,100	.0676		0.	.01	
199,584	2,200	.0718		0.	.01	
208,656	2,300	.0770		0.	.01	
217,728	2,400	.0829		0.	.01	
226,800	2,500	.0885		0.	.01	
235,872	2,600	.0959		−.01	.02	Ultimate strength.

Fibers crushed at groups of knots at three places along length of post.

No. 9190.

SPRUCE POST.

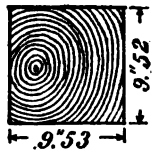
Length, 118".53.
Weight, 213 pounds=34.2 pounds per cubic foot.
Counterweight at middle, 106 pounds.
Average rate of growth, 20 rings per inch.
Sectional area, 9".52 × 9".53=90.72 square inches.
Gauged length, 50".
Taken from same stick as No. 9188.
Post contains 51 knots $\frac{1}{8}$" to 1" diameter.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,814	20	0.	0.	0.	0.	Initial load.
9,072	100	.0021	.....	.....	.....	
18,144	200	.0046	.....	.....	.....	
27,216	300	.0074	.....	.....	.....	
36,288	400	.0097	.....	.....	.....	
45,360	500	.0125	.....	0.	0.	
1,814	20	.....	.0003	.....	.....	
54,432	600	.0152	.....	.....	.....	
63,504	700	.0180	.....	.....	.....	
72,576	800	.0208	.....	.....	.....	
81,648	900	.0238	.....	.....	.....	
90,720	1,000	.0269	.....	0.	0.	
1,814	20	.....	.0005	.....	.....	
99,792	1,100	.0295	.....	.....	.....	
108,864	1,200	.0329	.....	.02	0.	
117,936	1,300	.0360	.....	.03	0.	
127,008	1,400	.0391	.....	.03	0.	
136,080	1,500	.0422	.....	.05	0.	
1,814	20	.....	.0006	.....	.....	
145,152	1,600	.0451	.....	.05	0.	
154,224	1,700	.0480	.....	.05	0.	
163,296	1,800	.0510	.....	.05	0.	
172,368	1,900	.0539	.....	.05	0.	
181,440	2,000	.0559	.....	.05	0.	
1,814	20	.....	.0007	.....	.....	
190,512	2,100	.0578	.....	.05	0.	
199,584	2,200	.0604	.....	.05	0.	
208,656	2,300	.0640	.....	.06	.02	
217,728	2,400	.0674	.....	.06	.03	
226,800	2,500	.0709	.....	.06	.03	
235,872	2,600	.0751	.....	.07	.04	
244,944	2,700	.0808	.....	.08	.07	
253,800	2,798	.....	.....	.....	.....	Ultimate strength.

Fibers crushed at knots 21" to 27" from end of post.

No. 9190 *a*.

RETEST OF SPRUCE POST NO. 9190, REDUCED IN LENGTH, CUTTING OFF THE PART FRACTURED IN THE ORIGINAL TEST.



Length, 85″.72.
Sectional area, 9″.52 × 9″.53 = 90.72 square inches.
Ultimate strength, 299,400 pounds = 3,300 pounds per square inch.
Fibres crushed at knot near middle of its length.

No. 9189.

SPRUCE POST.

Length, 119".94.
Weight, 222 pounds = 33.5 pounds per cubic foot.
Counterweight at middle, 111 pounds.
Average rate of growth, 16 rings per inch.
Sectional area, 9".76 × 9".78 = 95.45 square inches.
Gauged length, 50".
Post taken from the same stick as No. 9196.
Post contains 48 knots $\frac{1}{8}$" to $1\frac{1}{8}$" diameter.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,909	20	0.	0.	0.	0.	Initial load.
9,545	100	.0021	.....	.....	.....	
19,090	200	.0045	.....	.....	.....	
28,635	300	.0064	.....	.....	.....	
38,180	400	.0090	.....	.....	.....	
47,725	500	.0117	.....	0.	0.	
1,909	20	.....	.0014	.....	.....	
57,270	600	.0145	.....	.....	.....	
66,815	700	.0175	.....	.....	.....	
76,360	800	.0214	.....	.....	.....	
85,905	900	.0248	.....	.....	.....	
95,450	1,000	.0282	.....	0.	0.	
1,909	20	.....	.0020	.....	.....	
104,995	1,100	.0316	.....	.....	.....	
114,540	1,200	.0349	.....	.....	.....	
124,085	1,300	.0383	.....	.....	.....	
133,630	1,400	.0414	.....	.....	.....	
143,175	1,500	.0445	.....	0.	.01	
1,909	20	.....	.0028	.....	.....	
152,720	1,600	.0474	.....	.....	.....	
162,265	1,700	.0504	.....	.....	.....	
171,810	1,800	.0512	.....	.....	.....	
181,355	1,900	.0535	.....	0.	.02	
190,900	2,000	.0565	.....	0.	02	
1,909	20	.....	.0030	.....	.....	
200,445	2,100	.0600	.....	.....	.....	
209,990	2,200	.0630	.....	.....	.....	
219,535	2,300	.0674	.....	.....	.....	
229,080	2,400	.0719	.....	.....	.....	
238,625	2,500	.0772	.....	0.	.02	
1,909	20	.....	.0049	.....	.....	
248,170	2,600	.0830	.....	.....	.....	
257,715	2,700	.0908	.....	.01	.02	
267,260	2,800	.1046	.....	.06	.03	
276,900	2,901	.....	.....	.....	.....	Ultimate strength.

Fibers crushed at a group of knots near the middle of its length and in vicinity of each end.

No. 9196.

SPRUCE POST.

Length, 120".04.
Weight, 232 pounds = 35 pounds per cubic foot.
Counterweight at middle, 116 pounds.
Average rate of growth, 16 rings per inch.
Sectional area, 9".76 × 9".78 = 95.45 square inches.
Gauged length, 50".
Taken from same stick as No. 9189.
Post contains 27 knots $\frac{1}{8}$" to $\frac{7}{8}$" diameter.

Applied loads.		In gauged length.	Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,909	20	0.	0.	0.	0.	Initial load.
9,545	100	.0031	.....	.....	.....	
19,090	200	.0062	.....	.....	.....	
28,635	300	.0090	.....	.....	.....	
38,180	400	.0116	.....	.....	.....	
47,725	500	.0141	.....	0.	0.	
1,909	20	.....	.0002	.....	.....	
57,270	600	.0166	.....	.....	.....	
66,815	700	.0193	.....	.....	.....	
76,360	800	.0220	.....	.....	.....	
85,905	900	.0245	.....	.....	.....	
95,450	1,000	.0271	.....	0.	0.	
1,909	20	.....	.0004	.....	.....	
104,995	1,100	.0296	.....	.....	.....	
114,540	1,200	.0323	.....	.....	.....	
124,085	1,300	.0351	.....	0.	.01	
133,630	1,400	.0378	.....	.....	.....	
143,175	1,500	.0404	.....	0.	.02	
1,909	20	.....	.0005	0.	0.	
152,720	1,600	.0429	.....	.....	.....	
162,265	1,700	.0455	.....	0.	.03	
171,810	1,800	.0481	.....	0.	.04	
181,355	1,900	.0508	.....	0.	.05	
190,900	2,000	.0534	.....	0.	.06	
1,909	20	.....	.0006	.....	.....	
200,445	2,100	.0558	.....	0.	.07	
209,990	2,200	.0586	.....	0.	.08	
219,535	2,300	.0616	.....	0.	.09	
229,080	2,400	.0642	.....	0.	.09	
238,625	2,500	.0670	.....	0.	.10	
1,909	20	.....	.0009	0.	.01	
248,170	2,600	.0694	.....	0.	.10	
257,715	2,700	.0725	.....	0.	.11	
267,260	2,800	.0760	.....	0.	.11	
276,805	2,900	.0796	.....	0.	.12	
286,350	3,000	.0834	.....	0.	.13	
1,909	20	.....	.0025	0.	.01	
295,895	3,100	.0873	.....	0.	.19	
303,000	3,174	.....	.....	.....	.....	Ultimate strength.

Fibers crushed at a group of knots 22" from end of post.

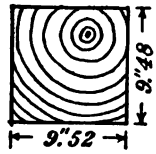
No. 9196*a*.

SHORT PIECE TAKEN FROM SPRUCE POST No. 9196.

Length, 14".12.
Sectional area, 9".76 × 9".78 = 95.45 square inches.
Ultimate strength, 329.900 = 3,456 pounds per square inch.

No. 9191.

SPRUCE POST.



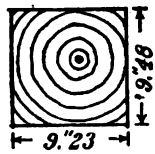
Length, 120".
Weight, 165½ pounds = 26.4 pounds per cubic foot.
Counterweight at middle, 83 pounds.
Average rate of growth, 5½ rings per inch.
Sectional area, 9".48 × 9".52 = 90.25 square inches.
Ganged length, 50".
Taken from same stick as No. 9195.
Post contains 70 knots ⅛" to 1⅛" diameter.

Applied loads.		In ganged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,805	20	0.	0.	0.	0.	Initial load.
9,025	100	.0040				
18,050	200	.0080				
27,075	300	.0120				
36,100	400	.0159				
45,125	500	.0201		0.	0.	
1,805	20		.0003			
54,150	600	.0241				
63,175	700	.0283				
72,200	800	.0329		.01	0.	
81,225	900	.0378				
90,250	1,000	.0409		.02	0.	
1,805	20		.0004			
99,275	1,100	.0446				
108,300	1,200	.0490				
117,325	1,300	.0534				
126,350	1,400	.0576				
135,375	1,500	.0620		.02	0.	
1,805	20		.0004			
144,440	1,600	.0660				
153,425	1,700	.0707				
162,450	1,800	.0753		.03	0.	
171,475	1,900	.0810				
180,500	2,000	.0876		.04	0.	
1,805	20		.0018			
189,525	2,100	.0938				
193,400	2,143					Ultimate strength.

Fibers crushed at knots 32" from end of post.

No. 9195.

SPRUCE POST.



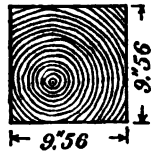
Length, 120″.07.
Weight, 166 pounds = 27.3 pounds per cubic foot.
Counterweight at middle, 83 pounds.
Average rate of growth, 5½ rings per inch.
Sectional area, 9″.23 × 9″.48 = 87.50 square inches.
Gauged length, 50″.
Taken from same stick as No. 9191.
Post contains 50 knots ⅛″ to 1½″ diameter. The knots were principally large ones.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,750	20	0.	0.	0.	0.	Initial load.
8,750	100	.0035	.....	.....	.....	
17,500	200	.0079	.....	.....	.....	
26,250	300	.0123	.....	.....	.....	
35,000	400	.0168	.....	.....	.....	
43,750	500	.0210	.....	0.	0.	
1,750	20	.....	.0002	.....	.....	
52,500	600	.0255	.....	.....	.....	
61,250	700	.0300	.....	.....	.....	
70,000	800	.0347	.....	.....	.....	
78,750	900	.0394	.....	.....	.....	
87,500	1,000	.0439	.....	0.	0.	
1,750	20	.....	.0005	.....	.....	
96,250	1,100	.0488	.....	.01	0.	
105,000	1,200	.0536	.....	.....	.....	
113,750	1,300	.0587	.....	.....	.....	
122,500	1,400	.0639	.....	.....	.....	
131,250	1,500	.0701	.....	.02	0.	
1,750	20	.....	.0011	.....	.....	
140,000	1,600	.0759	.....	.....	.....	
148,750	1,700	.0840	.....	.03	0.	
157,500	1,800	.0985	.....	.03	— .02	
166,250	1,900	.1255	.....	.03	— .06	Ultimate strength.

Fibers crushed at two groups of knots along middle part of post.

No. 9192.

SPRUCE POST.



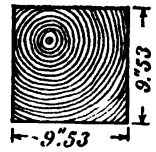
Length, 120".04.
Weight, 213 pounds = 33.5 pounds per cubic foot.
Counterweight at middle, 106 pounds.
Average rate of growth, 22 rings per inch.
Sectional area, 9".56 × 9".56 = 91.39 square inches.
Gauged length, 50".
Taken from same stick as No. 9194.
Post contains 36 knots $\frac{1}{8}$" to $\frac{1}{8}$" diameter.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,828	20	0.	0.	0.	0.	Initial load.
9,139	100	.0018	.....	.....	.....	
18,278	200	.0047	.....	.....	.....	
27,417	300	.0076	.....	.....	.....	
36,556	400	.0104	.....	.....	.....	
45,695	500	.0133	.....	0.	0.	
1,828	20	.....	0.	.....	.....	
54,834	600	.0163	.....	.....	.....	
63,973	700	.0192	.....	.....	.....	
73,112	800	.0222	.....	.....	.....	
82,251	900	.0251	.....	.....	.....	
91,390	1,000	.0283	.....	0.	0.	
1,828	20	.....	.0001	.....	.....	
100,529	1,100	.0312	.....	.....	.....	
109,668	1,200	.0342	.....	.....	.....	
118,807	1,300	.0374	.....	.....	.....	
127,946	1,400	.0405	.....	.....	.....	
137,085	1,500	.0435	.....	0.	0.	
1,828	20	.....	.0003	.....	.....	
146,224	1,600	.0465	.....	.....	.....	
155,363	1,700	.0501	.....	.....	.....	
164,502	1,800	.0533	.....	.....	.....	
173,641	1,900	.0564	.....	.....	.....	
182,780	2,000	.0599	.....	0.	0.	
1,828	20	.....	.0008	.....	.....	
191,919	2,100	.0630	.....	.....	.....	
201,058	2,200	.0668	.....	.....	.....	
210,197	2,300	.0717	.....	.....	.....	
219,336	2,400	.0758	.....	— .01	0.	
228,475	2,500	.0811	.....	— .01	0.	
1,828	20	.....	.0026	.....	.....	
237,614	2,600	.0869	.....	.....	.....	
246,753	2,700	.0985	.....	— .02	— .02	Ultimate strength.

Fibers crushed at knots 28" from end of post.

No. 9194.

SPRUCE POST.



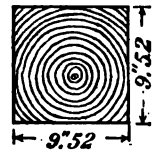
Length, 120″.05.
Weight, 222 pounds = 35.2 pounds per cubic foot.
Counterweight at middle, 111 pounds.
Average rate of growth, 23 rings per inch.
Sectional area, 9″.53 × 9″.53 = 90.82 square inches.
Gauged length, 50″.
Taken from same stick as No. 9192.
Post contains 16 knots $\frac{1}{8}$″ to $\frac{5}{8}$″ diameter.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,816	20	0.	0.	0.	0.	Initial load.
9,082	100	.0024	.....	.....	.....	
18,164	200	.0054	.....	.....	.....	
27,246	300	.0081	.....	.....	.....	
36,328	400	.0109	.....	.....	.....	
45,410	500	.0136	.....	0.	— .01	
1,816	20	.....	0.	.....	.....	
54,492	600	.0161	.....	0.	— .02	
63,574	700	.0187	.....	.....	.....	
72,656	800	.0214	.....	.....	.....	
81,738	900	.0240	.....	0.	— .03	
90,820	1,000	.0266	.....	.....	.....	
1,816	20	.....	0.	.....	.....	
99,902	1,100	.0292	.....	.01	— .04	
108,984	1,200	.0319	.....	.01	— .05	
118,066	1,300	.0345	.....	.01	— .06	
127,148	1,400	.0372	.....	.02	— .07	
136,230	1,500	.0400	.....	.02	— .07	
1,816	20	.....	.0002	.....	.....	
145,312	1,600	.0426	.....	.02	— .08	
154,394	1,700	.0453	.....	.....	.....	
163,476	1,800	.0482	.....	.03	— .09	
172,558	1,900	.0510	.....	.....	.....	
181,640	2,000	.0539	.....	.03	— .10	
1,816	20	.....	.0002	0.	0.	
190,722	2,100	.0564	.....	.04	— .10	
190,804	2,200	.0593	.....	.05	— .10	
208,886	2,300	.0624	.....	.06	— .11	
217,968	2,400	.0655	.....	.....	.....	
227,050	2,500	.0689	.....	.07	— .12	
1,816	20	.....	.0008	0.	0.	
236,132	2,600	.0723	.....	.08	— .14	
245,214	2,700	.0757	.....	.08	— .17	
254,296	2,800	.0808	.....	.09	— .18	
263,378	2,900	.0851	.....	.10	— .20	
272,460	3,000	.0899	.....	.10	— .21	
281,542	3,100	.1041	.....	.11	— .23	Ultimate strength.

Fibers crushed 19″ from end of post.

No. 9193.

SPRUCE POST.



Length, 120".02.
Weight, 190 pounds = 30.2 pounds per cubic foot.
Counterweight at middle, 95 pounds.
Average rate of growth, 16 rings per inch.
Sectional area, 9".52 × 9".52 = 90.63 square inches.
Gauged length, 50".
Taken from stick which furnished only one post.
Post contains 48 knots, ⅛" to 1¼" diameter. The larger number of knots were below ¼" diameter.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,812	20	0.	0.	0.	0.	Initial load.
9,063	100	.0018				
18,126	200	.0051				
27,189	300	.0085				
36,252	400	.0120				
45,315	500	.0156		0.	0.	
1,812	20		0.			
54,378	600	.0192				
63,441	700	.0228				
72,504	800	.0264				
81,567	900	.0300				
90,630	1,000	.0338		0.	0.	
1,812	20		.0005			
99,693	1,100	.0372		0.	.01	
108,756	1,200	.0412				
117,819	1,300	.0450				
126,882	1,400	.0489				
135,945	1,500	.0528		0.	.02	
	1,500	.0532				After 5 minutes.
1,812	20		.0013			
145,008	1,600	.0568				
154,071	1,700	.0607				
163,134	1,800	.0648				
172,197	1,900	.0689				
181,260	2,000	.0729		0.	.02	
	2,000	.0745				After 5 minutes.
	2,000	.0752				After 10 minutes.
	2,000	.0760				After 15 minutes.
	2,000	.0764				After 20 minutes.
	2,000	.0768				After 25 minutes.
	2,000	.0771				After 30 minutes.
	2,000	.0778				After 40 minutes.
	2,000	.0783				After 50 minutes.
	2,000	.0787				After 60 minutes.
	2,000	.0793				After 1 hour and 20 minutes.
	2,000	.0807				After 2 hours.
	2,000	.0812				After 2 hours and 20 minutes.
	2,000	.0818				After 2 hours and 40 minutes.
	2,000	.0823				After 3 hours.
1,812	20		.0038			
90,630	1,000	.0406				Remained under load 40 hours.
78,500	866					Load on post at end of 40 hours.
90,630	1,000	.0432				
181,260	2,000	.0810				
	2,000	.0822				After 5 minutes.
	2,000	.0825				After 10 minutes.
	2,000	.0831				After 20 minutes.

No. 9193—Continued.

Applied loads		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
.....	2,000	.0834	.....	.....	.....	After 30 minutes.
.....	2,000	.0842	.....	.....	.....	After 50 minutes.
.....	2,000	.0844	.....	.....	.....	After 1 hour.
.....	2,000	.0847	.....	.....	.....	After 1 hour and 10 minutes.
.....	2,000	.0851	.....	.....	.....	After 1 hour and 30 minutes.
.....	2,000	.0868	.....	.....	.....	After 2 hours.
						Temperature of room raised.
.....	2,000	.0888	.....	.....	.....	After 2 hours and 30 minutes.
.....	2,000	.0897	.....	.....	.....	After 3 hours.
						Temperature of room falling. Micrometer apparently affected by the change in temperature of room.
.....	2,000	.0901	.....	.....	.....	After 4 hours.
.....	2,000	.0903	.....	.....	.....	After 4½ hours.
.....	2,000	.0906	.....	.....	.....	After 5 hours.
.....	2,000	.0909	.....	.....	.....	After 5½ hours.
.....	2,000	.0913	.....	.....	.....	After 6 hours.
.....	2,000	.0916	.....	.....	.....	After 6½ hours.
.....	2,000	.0919	.....	.....	.....	After 7 hours.
.....	2,000	.0927	.....	.....	.....	After 7 hours and 30 minutes.
						Sun shone on micrometer 10 minutes.
.....	2,000	.0927	.....	.....	.....	After 8 hours.
181,260	2,000	.....	.....	.....	.....	Load left on post over night, 15 hours.
169,400	1,869	.....	.....	.....	.....	Load on post in the morning.
181,260	2,000	.0971	.....	.....	.....	
.....	2,000	.0975	.....	.....	.....	After 30 minutes.
163,134	1,800	.0902	.....	.....	.....	
181,260	2,000	.0975	.....	.....	.....	
163,134	1,800	.0902	.....	.....	.....	
181,260	2,000	.0977	.....	.....	.....	
163,134	1,800	.0903	.....	.....	.....	
181,260	2,000	.0977	.....	.....	.....	
190,323	2,100	.1014	.....	.....	.....	
199,386	2,200	.1057	.....	.....	.....	
.....	2,200	.1057	.....	.....	.....	After 5 minutes.
.....	2,200	.1063	.....	.....	.....	After 10 minutes.
.....	2,200	.1065	.....	.....	.....	After 15 minutes.
.....	2,200	.1072	.....	.....	.....	After 25 minutes.
.....	2,200	.1076	.....	.....	.....	After 30 minutes.
208,449	2,300	.1113	.....	.....	.....	
.....	2,300	.1124	.....	.....	.....	After 5 minutes.
.....	2,300	.1132	.....	.....	.....	After 10 minutes.
.....	2,300	.1143	.....	.....	.....	After 15 minutes.
.....	2,300	.1153	.....	.....	.....	After 20 minutes.
.....	2,300	.1160	.....	.....	.....	After 25 minutes.
.....	2,300	.1172	.....	.....	.....	After 30 minutes.
.....	2,300	.1180	.....	.....	.....	After 35 minutes.
.....	2,300	.1189	.....	.....	.....	After 40 minutes.
.....	2,300	.1199	.....	.....	.....	After 45 minutes.
.....	2,300	.1208	.....	.....	.....	After 50 minutes.
.....	2,300	.1218	.....	.....	.....	After 55 minutes.
.....	2,300	.1230	.....	.....	.....	After 1 hour.
.....	2,300	.1242	.....	.....	.....	After 1 hour 5 minutes.
.....	2,300	.1259	.....	.....	.....	After 1 hour 10 minutes.
.....	2,300	.1279	.....	.....	.....	After 1 hour 15 minutes.
.....	2,300	.1307	.....	.....	.....	After 1 hour 20 minutes.
.....	2,300	.1332	.....	.....	.....	After 1 hour 25 minutes.
.....	2,300	.1362	.....	.....	.....	After 1 hour 30 minutes.
181,260	2,000	.1247	.....	.....	.....	
.....	2,000	.1247	.....	.....	.....	After 5 minutes.
.....	2,000	.1247	.....	.....	.....	After 10 minutes.
.....	2,000	.1249	.....	.....	.....	After 15 minutes.
.....	2,000	.1253	.....	.....	.....	After 30 minutes.
.....	2,000	.1257	.....	.....	.....	After 45 minutes.
.....	2,000	.1258	.....	.....	.....	After 1 hour.
.....	2,000	.1264	.....	.....	.....	After 1 hour 15 minutes.
.....	2,000	.1271	.....	.....	.....	After 1 hour 45 minutes.
.....	2,000	.1273	.....	.....	.....	After 2 hours.
.....	2,000	.1277	.....	.....	.....	After 2 hours 15 minutes.
190,323	2,100	.1319	.....	.....	.....	
199,386	2,200	.1360	.....	.....	.....	
208,449	2,300	.1405	.....	.....	.....	
.....	2,300	.1469	.....	.....	.....	After 4 minutes.
208,449	2,300	.....	.....	.....	.....	Ultimate strength.

Fibers crushed at a group of knots 20″ from end of post, 15″ outside e gauged length.

TABLE SHOWING LOSS IN WEIGHT AFTER BEING EXPOSED TO TEMPERATURE OF 220° F. OF SLICES CUT FROM POSTS AFTER FRACTURE.

PINE POSTS.

Tension test No.	Description.	Original weight of post per cubic foot.	Loss in weight.
		Pounds.	*Per cent.*
9168	Long-leaf pine, from butt end of tree	49.5	23.61
9169	Long-leaf pine, from middle of same tree as No. 9168	45.5	20.97
9170	Long-leaf pine, from top of same tree as No. 9168	43.3	21.71
9171	Long-leaf pine, from top of tree	40.4	21.55
9172	....do	43.0	23.61
9173	Long-leaf pine, from butt of tree	45.6	23.81
9174	.....do	49.9	23.28
9175	Long-leaf pine, from top of tree	42.1	18.81
9176	Long-leaf pine, from butt of tree	53.4	18.58
9197	Short-leaf pine, from middle of tree	32.4	31.04
9198	Short-leaf pine, from top of same tree as No. 9197	38.3	23.08
9199	Short-leaf pine, from butt of same tree as No. 9197	41.9	26.22
9200	Short-leaf pine, from middle of tree	49.0	28.55
9201	Short-leaf pine, from butt of same tree as No. 9200	50.2	25.53
9202	Short-leaf pine, from top of same tree as No. 9200	47.3	31.57
9203	Long-leaf pine, from middle of tree. Stick from yard	42.3	20.26
9204	Long-leaf pine, from top of same tree as No. 9203. Stick from yard	40.3	18.58
9208	Long-leaf pine, from butt of same tree as No. 9203. Stick from yard	47.4	18.25

SPRUCE POSTS.

9177	.....	30.0	19.18
9188	.....	33.8	21.38
9190	From same tree as No. 9188	34.2	25.82
9189	.....	33.5	19.66
9196	From same tree as No. 9189	35.0	18.78
9191	.....	26.4	16.09
9195	From same tree as No. 9191	27.3	19.13
9192	.....	33.5	18.21
9194	From same tree as No. 9192	35.2	22.33
9193	.....	30.2	18.02

TABULATION OF TIMBER POSTS.

PINE POSTS.

No. of test.	Description.	Location in tree.	Weight.		Average rate of growth, rings per inch.	Dimensions.			Sectional area.	Ultimate strength.		Manner of failure.	Remarks.
			Total.	Per cubic foot.		Length.	Breadth.	Depth.		Total.	Per sq. inch.		
			Pounds.	*Pounds.*		*Inches.*	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*		
9168	Long leaf...	Butt....	330	49.5	8	119.78	9.81	9.79	96.04	403,370	4,200	Fibers crushed at the upper end of the post in the tree.	Clear stick, free from knots.
9169	.....do.....	Middle .	302	45.5	8	119.64	9.80	9.78	95.84	356,000	3,714	Fibers crushed at a knot 10″ from the upper end of post.	Post contains 9 knots from ⅜″ to 1½″ diameter.
9170	.....do.....	Top	284	43.3	8	118.65	9.76	9.79	95.55	323,350	3,384	Fibers crushed at a knot 1½″ diameter 32″ from the upper end of the post.	Post contains 8 knots from 1″ to 2″ diameter. Posts Nos. 9168, 9169, and 9170, taken from same 30-foot stick.
9171	.....do.....	Top	267	40.4	13	120.08	9.73	9.76	94.96	320,000	3,369	Fibers crushed at a knot, 4 feet 3 inches from the upper end of the post.	Post contains 2 knots 2″ diameter each. About 5 per cent of this stick sapwood.
9172	.....do.....	Top.....	284	43	15	119.88	9.75	9.77	95.26	342,936	3,600	Fibers crushed 2″ and 5″ from the end of post, in the vicinity of small knots.	Post contains 3 knots from ½″ to ¾″ diameter.
9173	.....do.....	Butt....	302	45.6	13	120.04	9.75	9.77	95.26	416,000	4,367	Fibers crushed at end of post .	Post free from knots.
9174	.....do.....	Butt....	329	49.9	16	119.95	9.74	9.74	94.87	448,500	4,727	Fibers crushed at a knot ⅝″ diameter, 15″ from end of post.	Post contains 5 knots ½″ to ¾″ diameter.
9175	.....do.....	Top.....	279	42.1	11	120.10	9.78	9.75	95.35	337,100	3,535	Failed at knots near middle of length of post.	Post contains 13 knots ½″ to 2″ diameter.
9176	.....do.....	Butt....	354	53.4	22	119.97	9.79	9.76	95.55	475,500	4,976	Fibers crushed 3 feet from end of post.	Post free from knots.
9197	Short leaf...	Middle..	274	41.1	3 to 3½	120.07	9.79	9.79	95.84	300,500	3,135	Fibers crushed at knots 22″ from end of post.	Post contains 10 knots ½″ to 1½″ diameter.
9198	.....do.....	Top.....	256	38.3	3	120	9.78	9.83	96.14	249,964	2,600	Fibers crushed at a 2″ knot, 16″ from the lower end of post.	Post contains 18 knots 1″ to 2″ diameter.
9199	.....do.....	Butt....	278	41.9	2½ to 2¾	120	9.77	9.78	95.55	290,200	3,037	Fibers crushed in an oblique line from end of post along 20″ of its length.	Post contains 8 knots ½″ to ¾″ diameter. Posts Nos. 9197, 9198, and 9199 from same 30-foot stick.

9200	.....do	Middle..	307	49	9 to 10	120.03	9.49	9.50	90.15	360,600	4,000	Failed by triple flexure, bending upward at the middle. Sapwood on the side of the post parallel to the direction of deflection.	Post contains no knots; 15 per cent of stick sapwood.
9201	.....do	Butt....	313	50.2	11	120.06	9.46	9.48	89.68	352,000	3,925	Fibers crushed near the end of post.	Post contains no knots.
9202	.....do	Top.....	296	47.3	8	119.98	9.49	9.50	90.15	306,510	3,400	Fibers crushed, taking an oblique direction, 2″ to 10″ from end of post.	Post contains 3 knots ¼″ to 2″ diameter; 20 per cent sapwood along the corners. Posts Nos. 9200, 9201, and 9202 from same 30-foot stick.
9203	Long leaf; stick from yard.	Middle..	282	42.3	6½	120.06	9.79	9.80	95.94	402,948	4,200	Fibers crushed at a 1¼″ knot, 20″ from end of post.	Post contains 6 knots ⅜″ to 1½″ diameter.
9204	.....do	Top.....	269½	40.3	8	120.02	9.79	9.82	96.14	365,332	3,800	Fibers crushed at large knot 36″ from end of post.	Post contains 8 knots ¾″ to 2½″ diameter.
9208	.....do	Butt....	315	47.4	8 to 8½	119.96	9.79	9.77	95.65	439,990	4,600	Fibers crushed 30″ from end of post. Cutting the post apart there was found a sound knot near the center ¾″ diameter.	Post contains no knots in sight. Posts Nos. 9203, 9204, and 9208, from same 30-foot stick.

TABULATION OF TIMBER POSTS—Continued.

SPRUCE POSTS.

No. of test.	Description.	Location in tree.	Weight.		Average rate of growth, rings per inch.	Dimensions.			Sectional area.	Ultimate strength.		Manner of failure.	Remarks.
			Total.	Per cubic foot.		Length.	Breadth.	Depth.		Total.	Per sq. inch.		
			Pounds.	*Pounds.*		*Inches.*	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*		
9177			198	30	13	119.88	9.75	9.76	95.16	216,800	2,278	Fibers crushed at group of knots 27″ from end of post.	Post contains 46 knots ⅜″ to 1¾″ diameter.
9188			212	33.8	20	119.26	9.53	9.52	90.72	235,872	2,600	Fibers crushed at groups of knots at three places along length of post.	Post contains 47 knots ⅛″ to 1½″ diameter.
9190			213	34.2	20	118.53	9.53	9.52	90.72	253,800	2,798	Fibers crushed at knots 21″ to 27″ from end of post.	Post contains 51 knots ⅛″ to 1″ diameter.
9190*a*						85.72	9.53	9.52	90.72	299,400	3,300	Retest after cutting off part fractured in test No. 9190.	Posts Nos. 9188 and 9190 taken from same stick.
9189			222	33.5	16	119.94	9.76	9.78	95.45	276,900	2,901	Fibers crushed at a group of knots near middle of its length, and in vicinity of each end.	Post contains 48 knots ⅛″ to 1½″ diameter.
9196			232	35	16	120.04	9.78	9.76	95.45	303,000	3,174	Fibers crushed at a group of knots 22″ from end of post.	Post contains 27 knots ⅛″ to ⅝″ diameter.
9196*a*						14.12	9.78	9.76	95.45	329,900	3,456	Short piece taken from post No. 9196.	Posts Nos. 9189 and 9196 taken from same stick.
9191			165½	26.4	5½	120	9.52	9.48	90.25	193,400	2,143	Fibers crushed at knots 32″ from end of post.	Post contains 70 knots ⅛″ to 1½″ diameter.
9195			166	27.3	5½	120.07	9.23	9.48	87.50	166,250	1,900	Fibers crushed at two groups of knots along middle part of post.	Post contains 50 knots ⅛″ to 1½″ diameter. They were principally large ones. Posts Nos. 9191 and 9195 taken from same stick.
9192			213	33.5	22	120.04	9.56	9.56	91.39	246,753	2,700	Fibers crushed at knots 28″ from end of post.	Post contains 36 knots ⅛″ to ⅞″ diameter.
9194			222	35.2	23	120.05	9.53	9.53	90.82	281,542	3,100	Fibers crushed 19″ from end of post.	Post contains 16 knots ¼″ to ⅝″ diameter. Posts Nos. 9192 and 9194 taken from same stick.
9193			190	30.2	16	120.02	9.52	9.52	90.63	208,449	2,300	Fibers crushed at a group of knots 20″ from end of post, 15″ outside the gauged length.	Post contains 48 knots ⅛″ to 1½″ diameter. The larger number of knots were below ¼″ diameter.

OLD YELLOW-PINE POSTS

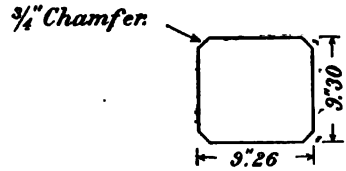
FROM

BOSTON FIRE BRICK CO. BUILDING, NO. 394 FEDERAL ST., BOSTON, MASS.

451

No. 9308.

Long Leaf Pine.



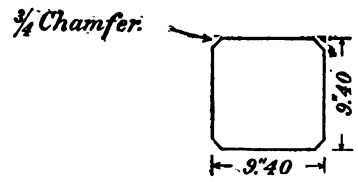
Length, 130".70.
Weight, 284 pounds=44.2 pounds per cubic foot.
Counterweighted at the middle.
Average rate of growth, 10 rings per inch.
Sectional area, 85 square inches.
Gauged length, 50".

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,700	20	0.	0.	0.	0.	Initial load.
8,500	100	.0013	.....	.....	.....	
17,000	200	.0028	.....	.....	.....	
25,500	300	.0046	.....	.....	.....	
34,000	400	.0062	.....	.....	.....	
42,500	500	.0081	.....	0.	0.	
1,700	20	.....	0.	.....	.....	
51,000	600	.0099	.....	.....	.....	
59,500	700	.0118	.....	.....	.....	
68,000	800	.0137	.....	.....	.....	
76,500	900	.0156	.....	.....	.....	
85,000	1,000	.0174	.....	0.	0.	
1,700	20	.....	0.	.....	.....	
102,000	1,200	.0210	.....	.....	.....	
119,000	1,400	.0249	.....	.....	.....	
136,000	1,600	.0287	.....	.....	.....	
153,000	1,800	.0326	.....	.....	.....	
170,000	2,000	.0366	.....	0.	0.	
1,700	20	.....	.0002	.....	.....	
187,000	2,200	.0404	.....	.....	.....	
204,000	2,400	.0443	.....	.....	.....	
221,000	2,600	.0483	.....	.....	.....	
238,000	2,800	.0523	.....	.....	.....	
255,000	3,000	.0561	.....	0.	0.	
1,700	20	.....	.0005	.....	.....	
272,000	3,200	.0599	.....	.....	.....	
289,000	3,400	.0641	.....	.....	.....	
306,000	3,600	.0682	.....	.....	.....	
323,000	3,800	.0727	.....	.....	.....	
340,000	4,000	.0769	.....	0.	0.	
1,700	20	.....	.0010	.....	.....	
357,000	4,200	.0808	.....	.....	.....	
374,000	4,400	.0851	.....	0.	— .01	
391,000	4,600	.0893	.....	.....	.....	
408,000	4,800	.0938	.....	.....	.....	
425,000	5,000	.0981	.....	0.	— .01	
1,700	20	.....	.0015	0.	0.	
442,000	5,200	.1021	.....	.....	.....	
459,000	5,400	.1067	.....	0.	— .02	
476,000	5,600	.1112	.....	.....	.....	
493,000	5,800	.1156	.....	.....	.....	
510,000	6,000	.1206	.....	0.	— .02	
1,700	20	.....	.0026	.....	.....	
527,000	6,200	.1248	.....	.....	.....	
544,000	6,400	.1304	.....	0.	— .02	
561,000	6,600	.1350	.....	0.	— .02	
510,000	6,000	.1236	.....	.....	.....	
.....	6,000	.1265	.....	.....	.....	After sustaining load 1 hour.
561,000	6,600	.1386	.....	.....	.....	
578,000	6,800	.1432	.....	0.	— .03	
595,000	7,000	.1479	.....	0.	— .03	
1,700	20	.....	.0069	.....	.....	
612,000	7,200	.1532	.....	0.	0.	
625,100	7,354	.....	.....	.....	.....	Ultimate strength.

Fibers crushed in vicinity of knots 26" and 55" from the bottom end of the post.

No. 9309.

LONG-LEAF PINE.



Length, 131".02.
Weight, 255 pounds = 38.6 pounds per cubic foot.
Counterweighted at the middle.
Average rate of growth, 9¼ rings per inch.
Sectional area, 87.24 square inches.
Gauged length, 50".

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,745	20	0.	0.	0.	0.	Initial load.
8,724	100	.0023				
17,448	200	.0050				
34,896	400	.0100				
52,344	600	.0149				
69,792	800	.0197				
87,240	1,000	.0244		0.	0.	
1,745	20		.0002			
122,136	1,400	.0339				
157,032	1,800	.0435				
191,928	2,200	.0532				
226,824	2,600	.0631				
261,720	3,000	.0728		0.	0.	
1,745	20		.0006			
296,616	3,400	.0825				Snapping sounds.
331,512	3,800	.0930		0.	— .02	
348,960	4,000	.0984		0.	— .02	
1,745	20		.0013			
366,408	4,200	.1032		0.	— .03	
383,856	4,400	.1086		0.	— .03	
401,304	4,600	.1140				
418,752	4,800	.1197				
436,200	5,000	.1254		0.	— .03	
1,745	20		.0027			
453,648	5,200	.1317		0.	— .04	
471,096	5,400	.1371		+ .01	— .05	
488,544	5,600	.1438		.02	— .06	
505,992	5,800	.1506		.03	— .07	
523,440	6,000	.1580		.04	— .08	
1,745	20		.0065	0.	0.	
570,600	6,541					Ultimate strength.

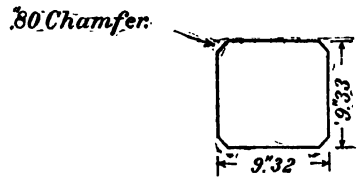
Fibers crushed at the end of the tenon at top end of post, opening cracks along the grain, and generally shattering this end of the post.

Area of tenon, 8".80 × 8".70 = 76.56 square inches.

Ultimate strength of timber at the tenon, 7,453 pounds per square inch.

No. 9310.

LONG-LEAF PINE.



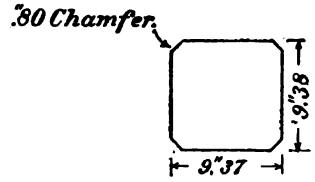
Length, 130".94.
Weight, 271 pounds = 41.8 pounds per cubic foot.
Counterweighted at the middle.
Average rate of growth, 17½ rings per inch.
Sectional area, 85.68 square inches.
Gauged length, 50".
One side of this post had been slightly charred by fire.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,713	20	0.	0.	0.	0.	Initial load.
8,568	100	.0018	.....	.....	.....	
17,136	200	.0038	.....	.....	.....	
34,272	400	.0079	.....	.....	.....	
51,408	600	.0116	.....	.....	.....	
68,544	800	.0155	.....	.....	.....	
85,680	1,000	.0195	.....	0.	0.	
1,713	20	.....	.0005	.....	.....	
119,952	1,400	.0270	.....	.....	.....	
154,224	1,800	.0348	.....	.....	.....	
188,496	2,200	.0425	.....	.....	.....	
222,768	2,600	.0505	.....	.....	.....	Snapping sounds.
257,040	3,000	.0585	.....	0.	0.	
1,713	20	.....	.0004	.....	.....	
291,312	3,400	.0661	.....	.....	.....	
325,584	3,800	.0745	.....	.....	.....	
359,856	4,200	.0825	.....	.....	.....	
394,128	4,600	.0904	.....	— .01	0.	
428,400	5,000	.0987	.....	— .02	+ .01	
1,713	20	.....	.0013	0.	0.	
445,536	5,200	.1024	.....	— .02	.03	
462,672	5,400	.1076	.....	— .04	.06	
479,808	5,600	.1114	.....	— .04	.07	
496,944	5,800	.1155	.....	— .04	.08	
514,080	6,000	.1223	.....	— .06	.10	
1,713	20	.....	.0032	0.	0.	
531,216	6,200	.1254	.....	— .05	.11	
551,100	6,432	.....	.....	.....	.....	Ultimate strength.

Fibers crushed at a knot, ¾" diameter, 26" from the upper end of the post. Generally shattered by splitting along the grain in this vicinity.

No. 9311.

LONG-LEAF PINE.



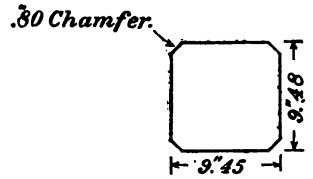
Length, 130″.71.
Weight, 336 pounds = 50.7 pounds per cubic foot.
Counterweighted at the middle.
Average rate of growth, 10½ rings per inch.
Sectional area, 86.6 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,732	20	0.	0.	0.	0.	Initial load.
8,660	100	.0020	.....	.....	.....	
17,320	200	.0041	.....	.....	.....	
34,640	400	.0081	.....	.....	.....	
51,960	600	.0119	.....	.....	.....	
69,280	800	.0158	.....	.....	.....	
86,600	1,000	.0196	.....	0.	0.	
1,732	20	.....	.0003	.....	.....	
121,240	1,400	.0274	.....	.....	.....	
155,880	1,800	.0351	.....	— .01	+ .01	
190,520	2,200	.0434	.....	— .02	.02	
225,160	2,600	.0517	.....	— .05	.06	
259,800	3,000	.0599	.....	— .06	.09	
1,732	20	.....	.0009	0.	0.	
294,440	3,400	.0681	.....	— .08	.10	
329,080	3,800	.0768	.....	— .09	.11	Snapping sounds.
363,720	4,200	.0853	.....	— .10	.12	
398,360	4,600	.0940	.....	— .10	.15	
433,000	5,000	.1038	.....	— .10	.19	
1,732	20	.....	.0019	0.	0.	
450,320	5,200	.1091	.....	— .10	.20	
467,640	5,400	.....	.....	.....	.....	Ultimate strength.

Split along the grain the full length of the post; fibers crushed 10″ from the upper end, in vicinity of knots.

No. 9312.

LONG-LEAF PINE.



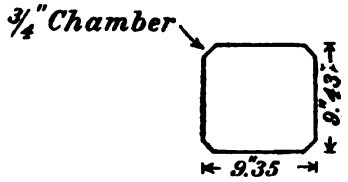
Length, 130".52.
Weight, 270 pounds = 40.5 pounds per cubic foot.
Counterweighted at the middle.
Average rate of growth, 7¼ rings per inch.
Sectional area, 88.3 square inches.
Gauged length, 50".

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,766	20	0.	0.	0.	0.	Initial load.
8,830	100	.0018	.....	.....	.....	
17,660	200	.0042	.....	.....	.....	
35,320	400	.0090	.....	.....	.....	
52,980	600	.0138	.....	.....	.....	
70,640	800	.0186	.....	.....	.....	
88,300	1,000	.0235	.....	0.	0.	
1,766	20	.....	.0002	.....	.....	
123,620	1,400	.0331	.....	.....	.....	
158,940	1,800	.0429	.....	0.	+ .01	
194,260	2,200	.0525	.....	0.	.02	Snapping sounds.
229,580	2,600	.0627	.....	— .06	.02	
264,900	3,000	.0725	.....	— .06	.02	
1,766	20	.....	.0007	— .03	0.	
300,220	3,400	.0825	.....	— .08	.03	
335,540	3,800	.0929	.....	— .09	.04	
370,860	4,200	.1032	.....	— .10	.07	
406,180	4,600	.1131	.....	— .12	.08	
438,000	4,960	.....	.....	.....	.....	Ultimate strength.

Fibers crushed in the vicinity of knots along the length of the post. Four knots, from 1¼" to 2½" diameter. Split the wood along the grain.

No. 9313.

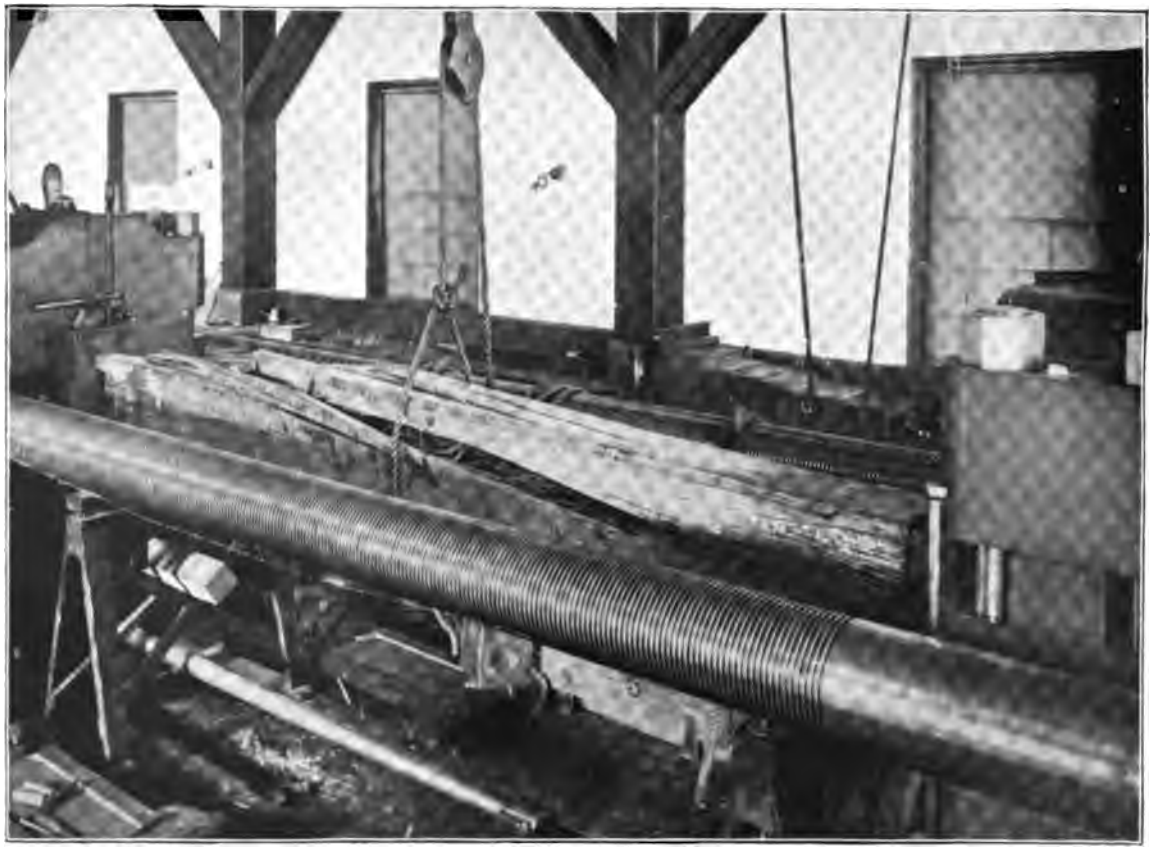
LONG-LEAF PINE.



Length, 130″.08.
Weight, 259 pounds = 39.6 pounds per cubic foot.
Counterweighted at the middle.
Average rate of growth, 11 rings per inch.
Sectional area, 87 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,740	20	0.	0.	0.	0.	Initial load.
8,700	100	.0019	.....	.....	.....	
17,400	200	.0040	.....	.....	.....	
34,800	400	.0088	.....	.....	.....	
52,200	600	.0138	.....	.....	.....	
69,600	800	.0187	.....	.....	.....	
87,000	1,000	.0235	.....	+.01	0.	
1,740	20	.....	.0003	0.	0.	
121,800	1,400	.0333	.....	.02	0.	
156,600	1,800	.0432	.....	.03	0.	
191,400	2,200	.0530	.....	.04	0.	
226,200	2,600	.0635	.....	.05	0.	Snapping sounds.
261,000	3,000	.0735	.....	.05	0.	
1,740	20	.....	.0002	0.	0.	
295,800	3,400	.0830	.....	.06	0.	
330,600	3,800	.0930	.....	.06	0.	
365,400	4,200	.1036	.....	.07	0.	
400,200	4,600	.1144	.....	.08	0.	
435,000	5,000	.1251	.....	.08	0.	
1,740	20	.....	.0011	0.	0.	
469,800	5,400	.1361	.....	.08	0.	
504,600	5,800	.1457	.....	.07	.03	
1,740	20	.....	.0039	.03	0.	
528,400	6,074	.....	.....	.....	.....	Ultimate strength.

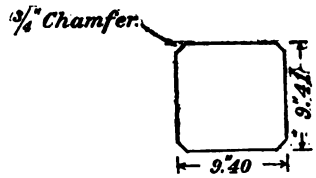
Oblique grain. Opened numerous cracks along the grain. Post generally shattered.



POST NO. 9313 AFTER FRACTURE.

No. 9314.

LONG-LEAF PINE.



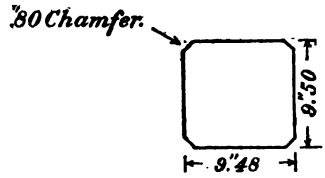
Length, 130″.45.
Weight, 256 pounds = 38.9 pounds per cubic foot.
Counterweighted at the middle.
Average rate of growth, 8½ rings per inch.
Sectional area, 87.3 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,746	20	0.	0.	0.	0.	Initial load.
8,730	100	.0020	.....	.....	.....	
17,460	200	.0045	.....	.....	.....	
34,920	400	.0091	.....	.....	.....	
52,380	600	.0138	.....	.....	.....	
69,840	800	.0183	.....	.....	.....	
87,300	1,000	.0228	.....	0.	0.	
1,746	20	.....	.0001	.....	.....	
122,220	1,400	.0317	.....	.02	0.	
157,140	1,800	.0410	.....	.....	.....	
192,060	2,200	.0504	.....	.....	.....	
226,980	2,600	.0597	.....	.03	.01	Slight snapping sounds.
261,900	3,000	.0692	.....	.04	.01	
1,746	20	.....	.0003	0.	0.	
261,900	3,000	.0692	.....	.....	.....	Load left on post over night, 16 hours.
251,000	2,875	.....	.....	.....	.....	Load on post in the morning.
261,900	3,000	.0717	.....	.04	.05	
296,820	3,400	.0809	.....	.03	.05	
331,740	3,800	.0900	.....	.....	.....	
366,660	4,200	.0995	.....	.03	.07	
401,580	4,600	.1094	.....	.03	.08	
436,500	5,000	.1195	.....	.03	.09	
1,746	20	.....	.0031	0.	.01	
471,420	5,400	.1304	.....	.03	.09	
506,340	5,800	.1427	.....	.03	.10	
541,260	6,200	.1566	.....	.02	.10	
576,180	6,600	.1756	.....	0.	.09	
1,746	20	.....	.0113	0.	.01	
607,500	6,959	.....	.....	.....	.....	Ultimate strength.

Fibers crushed 8″ and 50″ from the upper end of the post.

No. 9315.

Long Leaf Pine.

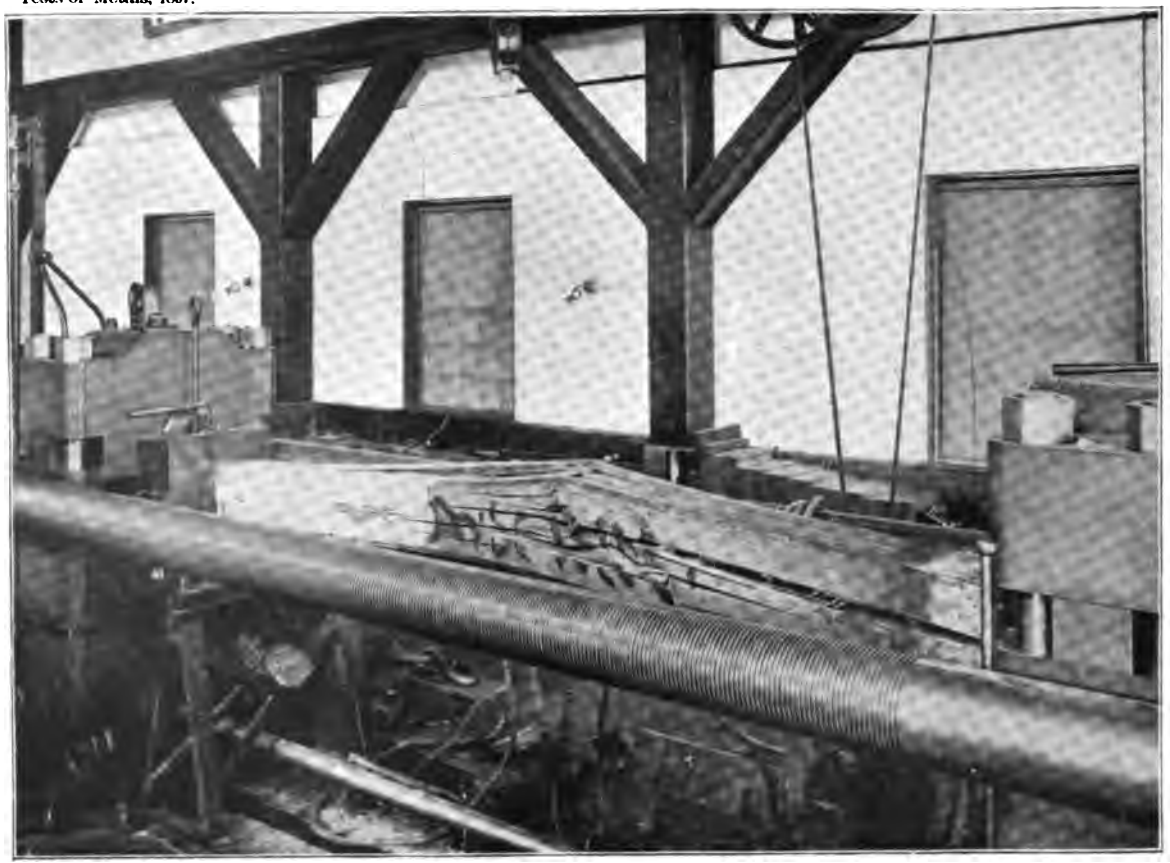


Length, 130″.50.
Weight, 267 pounds = 39.9 pounds per cubic foot.
Counterweighted at the middle.
Average rate of growth, 12 rings per inch.
Sectional area, 88.8 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,776	20	0.	0.	0.	0.	Initial load.
8,880	100	.0011	.....	.....	.....	
17,760	200	.0034	.....	.....	.....	
35,520	400	.0082	.....	.....	.....	
53,280	600	.0132	.....	.....	.....	
71,040	800	.0181	.....	.....	.....	
88,800	1,000	.0230	.....	0.	0.	
1,776	20	.....	0.	.....	.....	
124,320	1,400	.0328	.....	.....	.....	
159,840	1,800	.0427	.....	0.	.02	
195,360	2,200	.0532	.....	.....	.....	Snapping sounds.
230,880	2,600	.0631	.....	.....	.....	
266,400	3,000	.0732	.....	0.	.04	
1,776	20	.....	.0003	0.	0.	
301,920	3,400	.0831	.....	0.	.06	
337,440	3,800	.0933	.....	0.	.08	
372,960	4,200	.1037	.....	0.	.10	
408,480	4,600	.1139	.....	0.	.11	
444,000	5,000	.1243	.....	0.	.16	
1,776	20	.....	.0019	0.	.01	
479,520	5,400	.....	.....	.....	.....	Ultimate strength.

Fibers crushed at knots 26″ and 56″ from the lower end of the post. Size of knots, ½″ and 1¼″ diameter.

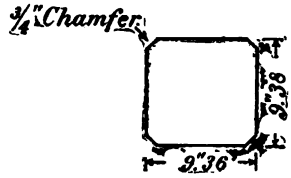
Opened cracks along the grain, generally shattering the post in the vicinity of the knots.



POST NO. 9315 AFTER FRACTURE.

No. 9316.

LONG LEAF PINE.



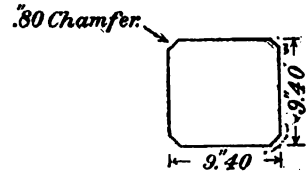
Length, 130".68.
Weight, 260 pounds = 39.7 pounds per cubic foot.
Counterweighted at the middle.
Average rate of growth, 7¾ rings per inch.
Sectional area, 86.68 square inches.
Gauged length, 50".

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,733	20	0.	0.	0.	0.	Initial load.
8,668	100	.0016				
17,336	200	.0035				
34,672	400	.0077				
52,008	600	.0119				
69,344	800	.0159				
86,680	1,000	.0200		0.	0.	
1,733	20		.0002			
121,352	1,400	.0281		.01	0.	
156,024	1,800	.0364				
190,696	2,200	.0446				
225,368	2,600	.0530		.02	0.	
260,040	3,000	.0613		.02	0.	
1,733	20		0.	0.	0.	
260,040	3,000	.0611		.02	0.	
	3,000	.0622		.02	0.	After 1 hour.
	3,000	.0622				After 2½ hours.
	3,000	.0623				After 3½ hours.
	3,000	.0623				After 4½ hours.
	3,000	.0623				After 20 hours.
	3,000	.0628				After 24 hours.
	3,000	.0630				After 26 hours.
	3,000	.0631				After 28 hours.
						The apparent increased compression after 24 hours attributed to rise of temperature of gauge rods.
294,712	3,400	.0712		.02	0.	
329,384	3,800	.0794		.06	.02	
346,720	4,000	.0835		.07	.02	
1,733	20		.0016	.05	.01	
346,720	4,000	.0833				
	4,000	.0838				After 45 minutes.
	4,000	.0840				After 1 hour and 45 minutes.
346,720	4,000					Load left on post Saturday evening.
335,700	3,872					Load found on the post the following Tuesday morning, after 64 hours rest.
346,720	4,000	.0867				
364,056	4,200	.0915		.06	.03	
398,720	4,600	.0995		.06	.05	Slight snapping sounds.
433,400	5,000	.1078		.07	.06	
1,733	20		.0050	.04	.01	
468,072	5,400	.1159		.07	.06	
502,744	5,800	.1243		.05	.08	
537,416	6,200	.1325		.04	.09	
572,088	6,600	.1390		.01	.12	
606,760	7,000					Ultimate strength.

Post deflected laterally and split along the grain its full length, dividing the post longitudinally into two parts.

No. 9317.

LONG-LEAF PINE.



Length, 130″.70.

Weight, 284 pounds = 43.1 pounds per cubic foot. Post put into cistern of water for the purpose of absorbing moisture. Remained in cistern 130 days.

Weight when removed from cistern, 315 pounds = 47.8 pounds per cubic foot.

Counterweighted at the middle.

Average rate of growth, 14½ rings per inch.

Sectional area, 87.08 square inches.

Gauged length, 50″.

The post was tested as soon as removed from the cistern, while in a wet condition.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,742	20	0.	0.	0.	0.	Initial load.
8,708	100	.0019	.....	0.	0.	
17,416	200	.0040	.....	0.	0.	
34,832	400	.0081	.....	0.	0.	
52,248	600	.0120	.....	0.	0.	
69,664	800	.0161	.....	.01	0.	
87,080	1,000	.0201	.....	.01	0.	
1,742	20	.....	.0005	0.	0.	
121,912	1,400	.0281	.....	.02	0.	
156,744	1,800	.0363	.....	.03	0.	
191,576	2,200	.0444	.....	.03	0.	
226,408	2,600	.0526	.....	.04	0.	
261,240	3,000	.0604	.....	.05	0.	
1,742	20	.....	.0011	0.	0.	
296,072	3,400	.0676	.....	.06	0.	
330,904	3,800	.0706	.....	.04	0.	Ultimate strength.
100,000	.....	.....	.....	.....	.....	Rested under this load 15 hours.

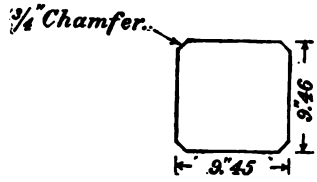
At the expiration of the above rest, loads were increased but did not again reach the maximum, 330,904 pounds.

The post failed by crushing the fibers and splitting longitudinally at the bottom end.

Water flowed out of the wood at the bottom end while the fibers were being crushed.

No. 9328.

LONG-LEAF PINE.



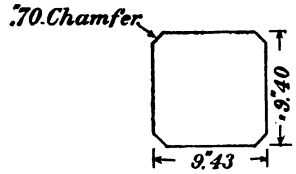
Length, 129".63.
Weight, 267½ pounds = 40.4 pounds per cubic foot.
Counterweighted at the middle.
Average rate of growth, 10 rings per inch.
Sectional area, 88.27 square inches.
Gauged length, 50".

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,765	20	0.	0.	0.	0.	Initial load.
8,827	100	.0013	.....	.....	.....	
17,654	200	.0036	.....	.....	.....	
35,308	400	.0084	.....	.....	.....	
52,962	600	.0132	.....	.....	.....	
70,616	800	.0180	.....	.....	.....	
88,270	1,000	.0228	.....	0.	0.	
1,765	20	.....	0.	.....	.....	
123,578	1,400	.0322	.....	.....	.....	
158,886	1,800	.0419	.....	.....	.....	
194,194	2,200	.0514	.....	.....	.....	
229,502	2,600	.0610	.....	.02	0.	
264,810	3,000	.0707	.....	.05	0.	
1,765	20	.....	.0005	0.	0.	
300,118	3,400	.0800	.....	.06	0.	
355,426	3,800	.0954	.....	.09	— .01	
370,734	4,200	.1001	.....	.10	— .01	
406,042	4,600	.1102	.....	.12	— .02	
441,350	5,000	.1193	.....	.20	— .03	
1,765	20	.....	.0012	0.	0.	
264,810	3,000	.0707	.....	.11	— .01	Load left on column over night.
250,800	2,841	.....	.....	.....	.....	Load found on the column in the morning, after 15 hours' rest.
264,810	3,000	.0731	.....	.14	— .02	
441,350	5,000	.1202	.....	.22	— .05	
476,658	5,400	.1292	.....	.31	— .07	Ultimate strength.

Fibers crushed at bottom end in the vicinity of small knots.

No. 9329.

LONG-LEAF PINE.



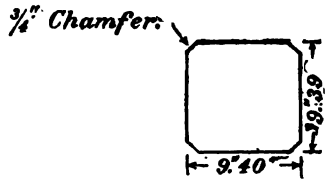
Length, 130".74.
Weight, 294 pounds = 44.4 pounds per cubic foot.
Counterweighted at the middle.
Average rate of growth, 11 rings per inch.
Sectional area, 87.66 square inches.
Gauged length, 50".
Season crack ".45 wide extends the length of the post on one side.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,753	20	0.	0.	0.	0.	Initial load.
8,766	100	.0014	.....	.....	.....	
17,532	200	.0035	.....	.....	.....	
35,064	400	.0078	.....	.....	.....	
52,596	600	.0123	.....	.....	.....	
70,128	800	.0168	.....	.....	.....	
87,660	1,000	.0214	.....	0.	0.	
1,753	20	.....	.0001	.....	.....	
122,724	1,400	.0304	.....	.....	.....	
157,788	1,800	.0395	.....	.....	.....	Slight snapping sounds.
192,852	2,200	.0486	.....	0.	— .02	Pronounced snapping sounds.
227,916	2,600	.0581	.....	0.	— .03	
262,980	3,000	.0674	.....	0.	— .04	
1,753	20	.....	.0006	0.	— .01	
298,044	3,400	.0766	.....	0.	— .06	
333,108	3,800	.0865	.....	0.	— .07	
368,172	4,200	.0967	.....	0.	— .09	
403,236	4,600	.1074	.....	0.	— .12	
438,300	5,000	.1193	.....	0.	— .18	
1,753	20	.....	.0021	0.	— .04	
474,000	5,407	.....	.....	.....	.....	Ultimate strength.

Fibers crushed in the vicinity of a knot $\frac{3}{8}$" diameter, 22" from top end.

No. 9330.

LONG LEAF PINE.



Length, 130″.05.
Weight, 290 pounds = 44.3 pounds per cubic foot.
Counterweighted at the middle.
Average rate of growth, 22½ rings per inch.
Sectional area, 87.14 square inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,743	20	0.	0.	0.	0.	Initial load.
8,714	100	.0013	.....	.....	.....	
17,428	200	.0033	.....	.....	.....	
34,856	400	.0073	.....	.....	.....	
52,284	600	.0114	.....	.....	.....	
69,712	800	.0155	.....	.....	.....	
87,140	1,000	.0195	.....	0.	0.	
1,743	20	.....	.0001	.....	.....	
121,996	1,400	.0275	.....	.01	0.	
156,852	1,800	.0354	.....	.02	0.	
191,708	2,200	.0440	.....	.03	0.	
226,564	2,600	.0525	.....	.04	0.	
261,420	3,000	.0610	.....	.05	0.	
1,743	20	.....	.0012	0.	0.	
296,276	3,400	.0689	.....	.06	0.	Snapping sounds.
331,132	3,800	.0777	.....	.07	0.	
365,988	4,200	.0865	.....	.08	0.	
400,844	4,600	.0958	.....	.10	0.	
435,700	5,000	.1048	.....	.11	— .01	
1,743	20	.....	.0018	.01	0.	
470,556	5,400	.1136	.....	.13	— .02	
505,412	5,800	.1249	.....	.17	— .03	
539,000	6,185	.....	.....	.....	.....	Ultimate strength.

Split along the grain, dividing the post into two nearly equal parts. One part crushed the fibers 36″ from bottom end; the other part crushed the fibers 27″ from top end.

164

No. 9331.

Long Leaf Pine.

Length, 129″.69.
Weight, 154 pounds = 41.2 pounds per cubic foot.
Counterweighted at the middle.
Average rate of growth, 15 rings per inch.
Mean sectional area of charred section:

	In.	In.	Sq. in.
Minimum	6.90 ×	6.80 =	46.92
Maximum	7.33 ×	7.07 =	51.82
Mean			49.37

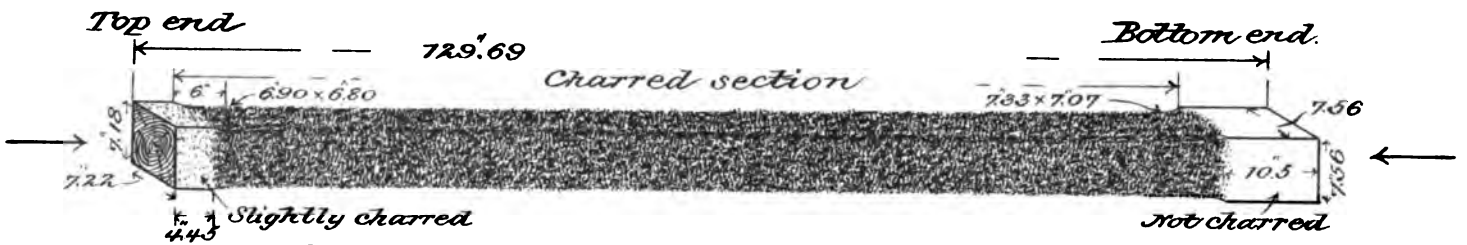
Gauged length, 50″.
Surface of post charred by fire.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
987	20	0.	0.	0.	0.	Initial load.
4,937	100	.0021				
9,874	200	.0049				
19,748	400	.0105				
29,622	600	.0163				
39,496	800	.0224				
49,370	1,000	.0282		0.	0.	
987	20		.0003			
69,118	1,400	.0400				
88,866	1,800	.0519				Snapping sounds.
108,614	2,200	.0639		0.	+ .01	
128,362	2,600	.0763				
148,110	3,000	.0885		0.	.01	
987	20		.0005	0.	0.	
167,858	3,400	.1010				
187,606	3,800	.1140				
207,354	4,200	.1275				
227,102	4,600	.1416				
246,850	5,000	.1575		0.	.00	
987	20		.0040	0.	0.	
266,598	5,400	.1744		—.02	— .02	
293,300	5,941					Ultimate strength.

Fibers crushed at a knot $1\frac{3}{8}$″ diameter at the middle of the length of the column.
The column deflected laterally, and broke in two at the middle.

No. 9331.

Old Yellow Pine Post.
Surface charred by fire.



Corners rounded by fire, except at ends.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 9331.

Long Leaf Pine.

Length, 129″.69.
Weight, 154 pounds = 41.2 pounds per cubic foot.
Counterweighted at the middle.
Average rate of growth, 15 rings per inch.
Mean sectional area of charred section:

	In.	In.	Sq. in.
Minimum	6.90 ×	6.80 =	46.92
Maximum	7.33 ×	7.07 =	51.82
Mean			49.37

Gauged length, 50″.
Surface of post charred by fire.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
987	20	0.	0.	0.	0.	Initial load.
4,937	100	.0021				
9,874	200	.0049				
19,748	400	.0105				
29,622	600	.0163				
39,496	800	.0224				
49,370	1,000	.0282		0.	0.	
987	20		.0003			
69,118	1,400	.0400				
88,866	1,800	.0519				Snapping sounds.
108,614	2,200	.0639		0.	+ .01	
128,362	2,600	.0763				
148,110	3,000	.0885		0.	.01	
987	20		.0005	0.	0.	
167,858	3,400	.1010				
187,606	3,800	.1140				
207,354	4,200	.1275				
227,102	4,600	.1416				
246,850	5,000	.1575		0.	.00	
987	20		.0040	0.	0.	
266,598	5,400	.1744		—.02	— .02	
293,300	5,941					Ultimate strength.

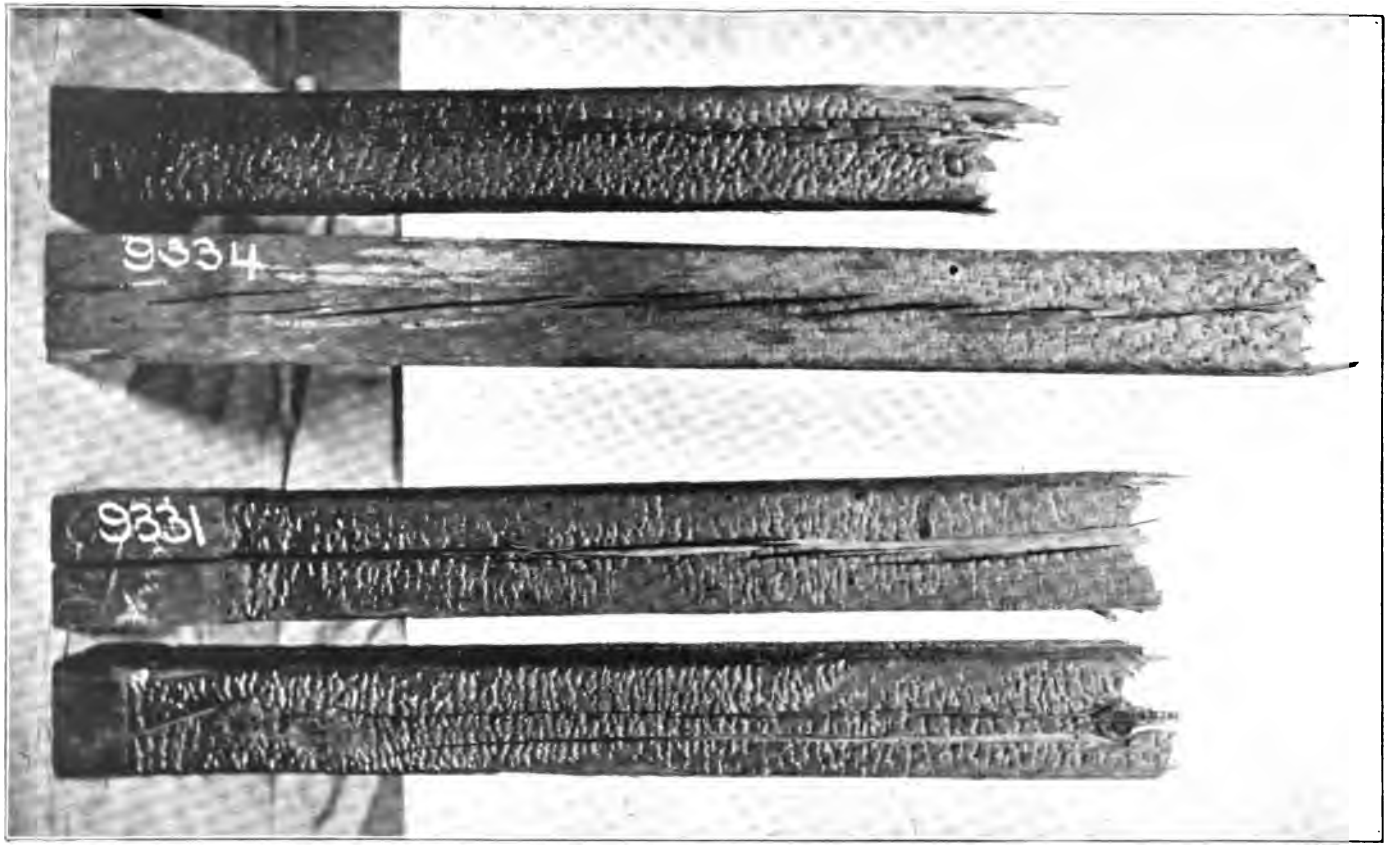
Fibers crushed at a knot $1\frac{3}{8}$″ diameter at the middle of the length of the column.
The column deflected laterally, and broke in two at the middle.

No. 9331.

Old Yellow Pine Post.
Surface charred by fire.

Corners rounded by fire, except at ends.

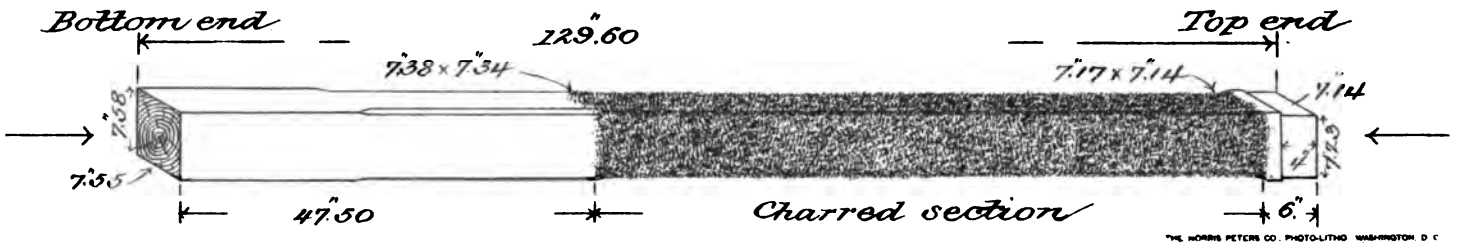
THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.



POSTS NOS. 9331 AND 9334 AFTER FRACTURE.

No. 9332.

Old Yellow Pine Post.
Surface charred by fire.



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No. 9332.

LONG LEAF PINE.

Length, 129″.60.
Weight, 169½ pounds = 41.8 pounds per cubic foot.
Counterweighted at the middle.
Average rate of growth, 18½ rings per inch.
Mean sectional area of column.

	In.	In.	Sq. in.
At bottom end	7.58	× 7.55	= 57.23
At lower end of charred section	7.34	× 7.38	= 54.17
At upper end of charred section	7.14	× 7.17	= 51.19
Mean			54.2

Gauged length, 50″.
Charred column.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,084	20	0.	0.	0.	0.	Initial load.
5,420	100	.0022				
10,840	200	.0051				
21,680	400	.0117				
32,520	600	.0180				
43,360	800	.0244				
54,200	1,000	.0309		0.	0.	
1,084	20		.0006			
75,880	1,400	.0430		.01	0.	
97,560	1,800	.0563		.02	0.	
119,240	2,200	.0691		.04	0.	Snapping sounds.
140,920	2,600	.0825		.05	0.	
162,600	3,000	.0963		.07	0.	
1,084	20		.0008	0.	0.	
162,600	3,000	.0963		.08	0.	
	3,000	.0993		.08	0.	After sustaining load 1 hour.
1,084	20		.0026			
184,280	3,400	.1120		.10	0.	
205,960	3,800	.1260		.11	— .02	
227,640	4,200	.1407		.13	— .02	
249,320	4,600	.1578		.18	— .04	
264,400	4,878					Ultimate strength.

Post crushed in the vicinity of three knots about 1″ diameter each, at middle of length.

No. 9333.

LONG-LEAF PINE.

Length, 130″.30.
Weight, 160 pounds = 42.5 pounds per cubic foot.
Counterweighted at the middle.
Average rate of growth, 10 rings per inch.
Mean sectional area of charred section:

	In.	In.	Sq. in.
Near top end	6.79	× 6.88	= 46.72
11″ from the bottom	7.09	× 7.08	= 50.20
Mean, not allowing for 1⅛″ hole			48.46

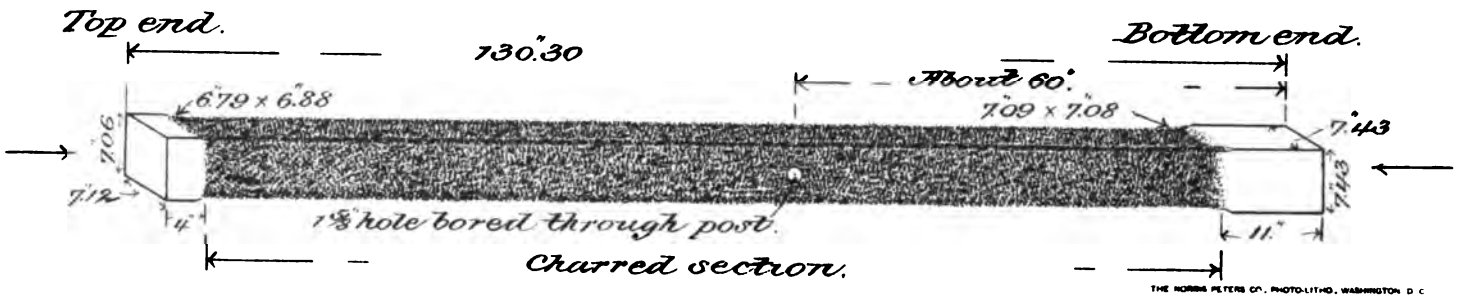
Sectional area through center of 1⅛″ hole, 37.13 square inches.
Gauged length, 50″.
Post charred by fire.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square foot.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
969	20	0.	0.	0.	0.	Initial load.
4,846	100	.0014	.....	.....	.....	
9,692	200	.0034	.....	.....	.....	
19,384	400	.0075	.....	.....	.....	
29,076	600	.0115	.....	.....	.....	
38,768	800	.0155	.....	.....	.....	
48,460	1,000	.0196	.....	0.	0.	
969	20	.....	.0002	.....	.....	
67,844	1,400	.0275	.....	.....	.....	
87,228	1,800	.0357	.....	.....	.....	
106,612	2,200	.0438	.....	.....	.....	
125,996	2,600	.0519	.....	.....	.....	
145,380	3,000	.0601	.....	0.	.01	
969	20	.....	.0002	.....	.....	
164,764	3,400	.0682	.....	0.	.02	
184,148	3,800	.0768	.....	— .01	.04	
203,532	4,200	.0856	.....	— .04	.06	
222,916	4,600	.0947	.....	— .06	.07	
242,300	5,000	.1040	.....	— .08	.09	
969	20	.....	.0016	0.	0.	
261,684	5,400	.1144	.....	— .10	.10	
281,068	5,800	.1278	.....	— .13	.12	
298,000	6,149	.....	.....	.....	.....	Ultimate strength.
	8,026	.....	.....	.....	.....	Through center of bored hole.

Fibers crushed opposite 1⅛″ bored hole.

No. 9333.

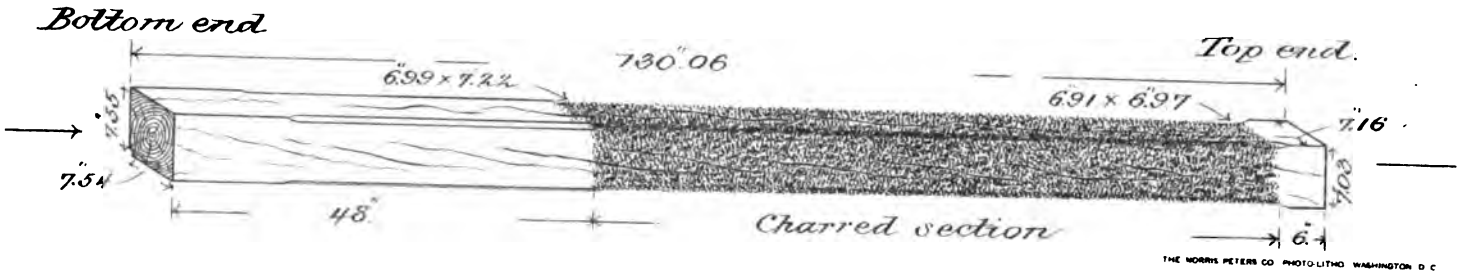
Old Yellow Pine Post.
Surface charred by fire.



THE HORNING PETERS CO., PHOTO-LITHO., WASHINGTON D. C.

No. 9334.

Old Yellow Pine Post.
Surface charred by fire.



THE NORRIS PETERS CO. PHOTO-LITHO. WASHINGTON, D. C.

No. 9334.

OLD SHORT-LEAF PINE POST, CHARRED BY FIRE.

Length, 130″.06.
Weight, 145 pounds = 37.8 pounds per cubic foot.
Counterweighted at the middle.
Average rate of growth, 4½ rings per inch.
Mean sectional area of charred section:

	In.	In.	Sq. in.
Near top of post	6.91	× 6.97	= 48.16
48″ from bottom of post	6.99	× 7.22	= 50.47
Mean			49.31

Gauged length, 50″.
Season cracks on all four faces. The charred timber had been hewed off from one face of the column.

Applied loads.		In gauged length.		Deflections at middle.		Remarks.
Total.	Per square inch.	Compression.	Set.	Horizontal.	Vertical.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
986	20	0.	0.	0.	0.	Initial load.
4,931	100	.0028				
9,862	200	.0065				
19,724	400	.0138				
29,586	600	.0217				
39,448	800	.0295		— .01	0.	
49,310	1,000	.0371		— .03	0.	
986	20		.0005	0.	0.	
69,034	1,400	.0527		— .10	0.	
88,758	1,800	.0688		— .12	0.	
108,482	2,200	.0851		— .17	0.	
128,206	2,600	.1025		— .21	0.	
147,930	3,000	.1207		— .27	0.	
986	20		.0026	0.	0.	
167,654	3,400	.1405		— .36	0.	
187,378	3,800	.1644		— .47	0.	
217,300	4,407					Ultimate strength.

Post deflected laterally and crushed the fibers near the middle of its length, the post separating into two parts.

TABLE SHOWING LOSS IN WEIGHT, AFTER BEING EXPOSED TO TEMPERATURE OF 220° F., OF SLICES CUT FROM POSTS AFTER FRACTURE.

OLD YELLOW PINE POSTS.

Tension test No.	Description.	Original weight of post per cubic foot.	Loss in weight.
		Pounds.	*Per cent.*
9308	Long-leaf pine	44.2	6.29
9309	.....do	38.6	3.05
9310	Long-leaf pine. One side of post slightly charred by fire	41.8	0.18
9311	Long-leaf pine	50.7	1.14
9312	.....do	40.5	1.75
9313	.....do	39.6	0.00
9314	.....do	38.9	5.93
9315	.....do	39.9	1.87
9316	.....do	39.7	3.55
9317	Long-leaf pine. Post kept in cistern of water 130 days	47.8	.....
	Slice 26″ from bottom of post	.....	14.48
	Slice from middle of length	.....	16.17
	Slice 12″ from top of post	.....	16.82
	Slice from top of post	.....	24.43
9328	Long-leaf pine	40.4	8.66
9329	.....do	44.4	4.31
9330	.....do	44.3	4.18

OLD YELLOW PINE POSTS, WHOSE SURFACES HAD BEEN CHARRED BY FIRE.

9331	Long-leaf pine	41.2	3.36
9332	.....do	41.8	4.45
9333	.....do	42.5	8.75
9334	Short-leaf pine	37.8	8.72

OLD PINE POSTS FROM BOSTON FIRE BRICK COMPANY BUILDING, NO. 394 FEDERAL STREET, BOSTON, MASS.

No. of test.	Description.	Weight.		Average rate of growth, rings per inch.	Dimensions.				Sectional area.	Ultimate strength.		Manner of failure.	Remarks.
		Total.	Per cubic foot.		Length.	Breadth.	Depth.	Corners chamfered.		Total.	Per square inch.		
		Pounds.	*Pounds.*		*Inches.*	*Inches.*	*Inches.*	*Inch.*	*Sq. ins.*	*Pounds.*	*Pounds.*		
9308	Long leaf.....	284	44.2	10	130.70	9.26	9.30	¾	85.00	625,100	7,354	Fibers crushed in vicinity of knots 26″ and 55″ from the bottom end of post.	
9309	.....do	255	38.6	9½	131.02	9.40	9.40	¾	87.24	570,600	6,541	Fibers crushed at the end of the tenon at top end of post, opening cracks along the grain and generally shattering this end of the post.	Ultimate strength on the tenon, 7,453 pounds per square inch.
9310	.....do	271	41.8	17½	130.94	9.32	9.33	.80	85.68	551,100	6,432	Fibers crushed at a knot ¾″ diameter, 26″ from the upper end of the post. Generally shattered by splitting along the grain in this vicinity.	One side of this post had been slightly charred by fire.
9311	.....do	336	50.7	10½	130.71	9.37	9.33	.80	86.06	467,640	5,400	Split along the grain the full length of the post, fibers crushed 10″ from the upper end in vicinity of knots.	
9312	.....do	270	40.5	7½	130.52	9.45	9.48	.80	88.3	438,000	4,960	Fibers crushed in the vicinity of knots along the length of the post. Four knots from 1½″ to 2½″ diameter. Split the wood along the grain.	
9313	.....do	259	39.6	11	130.08	9.35	9.43	¾	87.0	528,400	6,074	Oblique grain. Opened numerous cracks along the grain. Post generally shattered.	
9314	.....do	256	38.9	8½	130.45	9.40	9.41	¾	87.3	607,500	6,959	Fibers crushed 8″ and 50″ from the upper end of the post.	
9315	.....do	267	39.9	12	130.50	9.48	9.50	.80	88.8	479,520	5,400	Fibers crushed at knots 26″ and 56″ from the lower end of the post. Size of knots, ½″ and 1¼″ diameter. Opened cracks along the grain, generally shattering the post in the vicinity of the knots.	
9316	.....do	260	39.7	7¾	130.68	9.36	9.38	¾	86.68	606,760	7,000	Post deflected laterally and split along the grain its full length, dividing the post longitudinally into two parts.	

OLD PINE POSTS FROM BOSTON FIRE BRICK COMPANY BUILDING, ETC.—Continued.

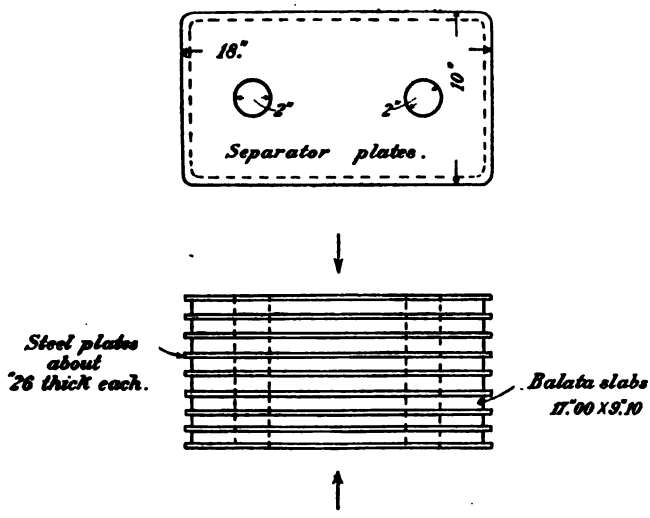
No. of test.	Description.	Weight.		Average rate of growth, rings per inch.	Dimensions.				Sectional area.	Ultimate strength.		Manner of failure.	Remarks.
		Total.	Per cubic foot.		Length.	Breadth.	Depth.	Corners chamfered.		Total.	Per square inch.		
		Pounds.	*Pounds.*		*Inches.*	*Inches.*	*Inches.*	*Inch.*	*Sq. ins.*	*Pounds.*	*Pounds.*		
9317	Long leaf after soaking in cistern of water 130 days.	284	43.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	Weight while dry.
		315	47.8	.....	130.70	9.40	9.40	.80	87.08	330,904	3,800	Fibers crushed and split longitudinally at the bottom end.	Post tested as soon as removed from the cistern while in a wet condition.
9328	Long leaf.....	267½	40.4	10	129.63	9.45	9.46	½	88.27	476,658	5,400	Fibers crushed at the bottom end in the vicinity of small knots.	
9329	.....do.....	294	44.4	11	130.74	9.43	9.40	.70	87.66	474,000	5,407	Fibers crushed in the vicinity of a knot ⅜" diameter, 22" from top end.	Season crack ".45 wide extends the length of the post on one side.
9330	.....do.....	290	44.3	22½	130.05	9.40	9.39	½	87.14	539,000	6,185	Split along the grain dividing the post into two nearly equal parts. One part crushed the fibers 36" from bottom end, the other part crushed the fibers 27" from the top end.	

OLD PINE POSTS WHOSE SURFACES HAD BEEN CHARRED BY FIRE.

No. of test.	Description.	Weight.		Average rate of growth, rings per inch.	Dimensions.			Mean sectional area.	Ultimate strength.		Manner of failure.	Remarks.
		Total.	Per cubic foot.		Length.	Mean.			Total.	Per square inch.		
						Breadth.	Depth.					
		Pounds.	*Pounds.*		*Inches.*	*Inches.*	*Inches.*	*Sq. ins.*	*Pounds.*	*Pounds.*		
9331	Long leaf.....	154	41.2	15	129.69	6.94	7.115	49.37	293,300	5,941	Fibers crushed at a knot 1⅝″ diameter at the middle of the length of the column. The column deflected laterally and broke in two at the middle.	
9332	.....do.....	169½	41.8	18½	129.60	7.367	7.36	54.2	264,400	4,878	Post crushed in the vicinity of three knots, about 1″ diameter each, at middle of length.	
9333	.....do.....	160	42.5	10	130.30	6.98	6.94	48.46	298,000	6,149	Fibers crushed opposite 1⅝″ bored hole.	1⅝″ hole bored through post about 60″ from bottom end.
						At bored hole.						
						6.98	5.32	37.13		8,026		
9334	Short leaf.....	145	37.8	4½	130.06	7.095	6.95	49.31	217,300	4,407	Post deflected laterally and crushed the fibers near the middle of its length, the post separating into two parts.	Season cracks on all four faces.

COMPRESSION TESTS OF BALATA SLABS.

COMPRESSION TESTS OF BALATA SLABS.

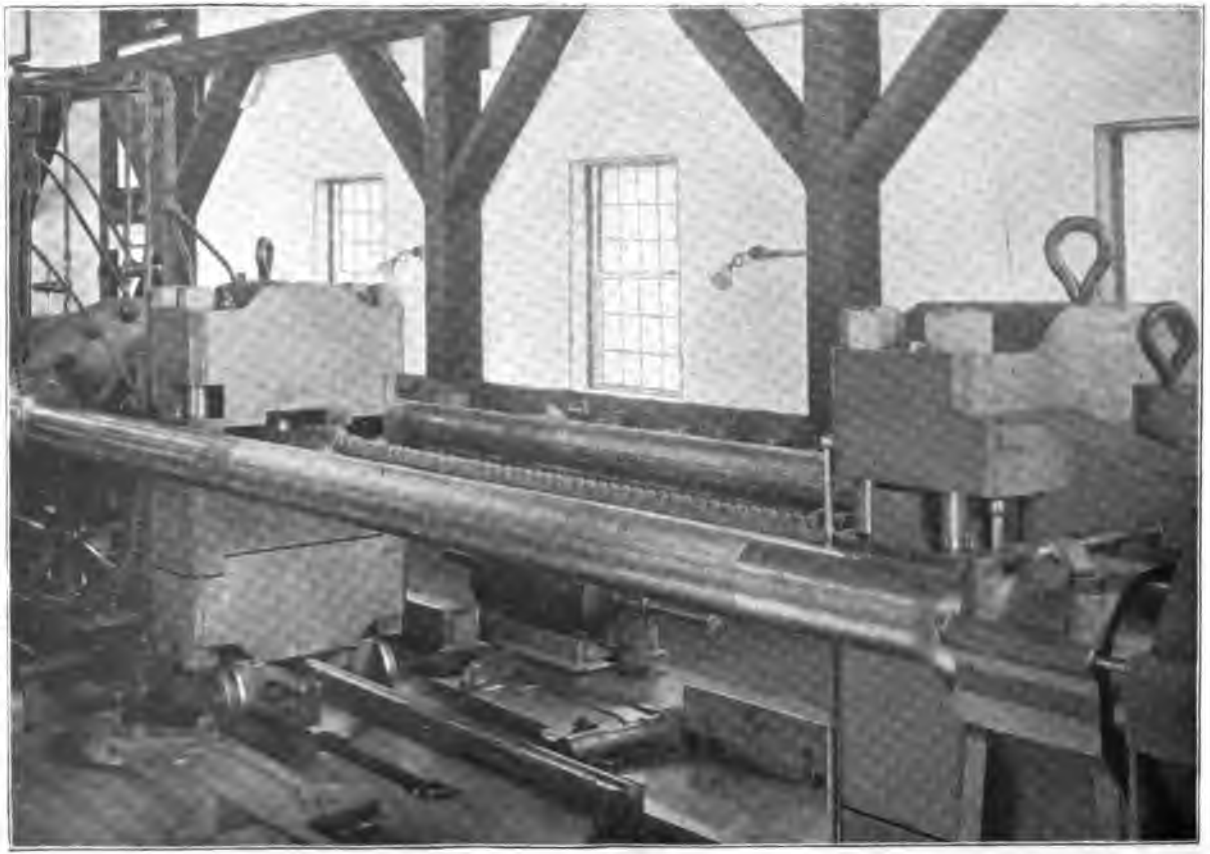


Applied loads.	Total height.	Compression.	Remarks.
Pounds.	*Inches.*	*Inch.*	
1,000	8.68	.....	
5,000	8.65	0.03	
10,000	8.63	.05	
20,000	8.62	.06	
50,000	8.60	.08	
100,000	8.59	.09	
50,000	8.59	.09	
20,000	8.60+	.08	
150,000	8.57	.11	
200,000	8.54	.14	
50,000	8.57	.11	
200,000	8.53	.15	
200,000	8.52+	.16	After 5 minutes.
50,000	8.56	.12	
20,000	8.57	.11	
200,000	8.53	.15	
20,000	8.57	.11	
280,000	.....	.....	Third slab spread laterally.
20,000	8.50	.18	

Test discontinued.

CORDAGE.

MANILA, HEMP, SISAL, AND COTTON ROPES.



10-INCH MANILA ROPE ATTACHED TO TESTING MACHINE.

CORDAGE.

These tests comprise samples of hemp, manila, sisal, cotton, and steel-wire rope, in sizes ranging from 6 thread to 10-inches circumference.

The material was chiefly contributed by the Sewall & Day Mills, Boston, Mass., and the Bureau of Equipment, United States Navy, Boston Navy-Yard. Some of the tested material was purchased rope from the arsenal store, and the cotton line was obtained by direct purchase.

The samples were prepared for testing with eye-splices at the ends, which were passed over pins held in the testing machine, and were thus secured during the tests. The samples were from 6 to 8 feet long between splices, and were wetted at the splices before testing.

The main series of tests for determining the tensile strength of the different sizes were followed by tests of an investigative character in which the elongations of the ropes were measured, their recovery in length upon release of loads, and subsequent behavior when reloaded.

Both dry and wet ropes were thus tested. There were tests with repeated stresses, in which the elongations were first measured, then repeated loads applied and followed by further observations on the elongations of the ropes. Also tests in which the ropes were strained in the testing machine and then wetted while still in the machine and the effect on elongation measured.

There were tests of knots and hitches. Weights were suspended by ropes of different sizes for periods of time, during which the ropes were exposed to different conditions of moisture, measuring the lengths of the samples at frequent intervals.

The free contraction in length of ropes was ascertained on samples immersed in a tank of water.

There were observations carried out on short samples on the changes in weight due to the varying amounts of moisture absorbed from the atmosphere and chemical analysis of the ashes of sisal fibers.

Following the tabulation of the tensile tests is a table showing the mean tensile strength of each size rope, the strength per thread and tensile strength per pound weight per fathom of the material.

In the series of tests on the manila ropes furnished by the Sewall & Day Mills the mean tensile strength ranged from 758 pounds for the 6 thread lines to 73,910 pounds for the 10-inch rope.

The strength of the rope per pound weight per fathom of length is seen to range from a maximum of 7,751 pounds to a minimum of 4,129 pounds.

The strength of the ropes per pound of material shows a general tendency to decrease as the size increases.

The difference in the length of the yarns in the strands, which difference increases with the size of the strand, doubtless contributes toward this result.

As an aid to the memory in estimating the approximate strength of a rope of a given size, figures based on the strength per square inch of the rope are useful, assuming the sectional area of the rope to be that of a circle of the same diameter.

On such an assumption the strength of the smaller sizes showed a tensile strength per square inch of 15,000 pounds, while the largest sizes gave about 7,000 pounds per square inch.

The actual strength of individual fibres were found as follows:

Fiber.	Diameter.	Sectional area.	Tensile strength.	
			Total.	Per square inch.
	Inch.	*Sq. inch.*	*Pounds.*	*Pounds.*
Manila	.0070	.000038	3½	92, 105
	.0065	.000033	3¼	98, 485
	.0080	.000050	6¾	135, 000
	.0070	.000038	5½	144, 737
	.0064	.000032	4	125, 000
American flax	.02 x .002	.000040	3½	87, 500
	.025 x .0026	.000065	6½	100, 000
Russia flax	.045 x .003	.000135	2¾	20, 370
	.025 x .003	.000075	3½	46, 667
	.04 x .0024	.000096	4¼	44, 271

The length of yarns in several of the ropes of the Sewall & Day Mills manufacture, when unlaid, were found as follows:

Rope.	Length of rope.	Length of strands.	Mean length of yarns.				
			Outside course.	Second course.	Third course.	Fourth course.	Center.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
6-thread manila		28.70	29.65				
	25	28.85	29.75				
		28.75					
15-thread manila		29.00	31.14				
	25	29.05					
		29.00					
2-inch manila		30.50	33.75				
	25	30.40					
		30.50					
3-inch manila		30.10	32.03	30.12			
	25	30.05					
		30.00					
3-inch manila		30.00	32.48				30.02
	25	30.05					
		29.95					
		29.90					
	Core. 25.10	29.05	29.50				
		29.00					
		29.05					
4-inch manila		31.30	33.78	32.12			31.35
	25	31.30					
		31.25					
5-inch manila		31.20	33.75	32.72	32.16		31.62
	25	31.25					
		31.20					
6-inch manila		32.40	34.74	33.73	33.12	32.48	32.10
	25	32.35					
		32.40					

The maximum and minimum length of yarns in the several courses of the different ropes were found to be—

Course.	Maximum and minimum length of yarns.							
	6-thread manila.	15-thread manila.	2-inch manila.	3-inch manila, 3-strand.	3-inch manila, 4-strand.	4-inch manila.	5-inch manila.	6-inch manila.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
Outside	29.10	31.00	33.65	31.60	31.70	33.65	33.50	34.30
	30.10	31.30	32.95	32.25	33.00	34.00	34.00	35.25
Second	.....	.....	.....	30.20	.....	31.85	32.50	33.35
	.....	.....	.....	30.30	.....	32.40	32.90	34.30
Third	.....	.....	.....	.....	.....	.....	32.05	32.85
	.....	.....	.....	.....	.....	.....	32.30	33.40
Fourth	.....	.....	.....	.....	.....	.....	.....	32.25
	.....	.....	.....	.....	.....	.....	.....	32.70
Center	.....	.....	.....	.....	30.00	31.30	31.55	32.05
	.....	.....	.....	.....	30.05	31.40	31.70	32.15
Core	.....	.....	.....	.....	29.50	.....	.....	.....

The strength of a rope is impaired by a knot or hitch of any kind.

The table which follows shows the strength of the plain rope and the strength of different knots and hitches.

The greater strength of a knot in wet rope over those in a dry specimen will be observed in the results.

Strength of plain rope, and same with knots and hitches.

Rope.	Knot or hitch at middle.	Tensile strength.		Efficiency.	Remarks.
		Plain rope.	With knot.		
		Pounds.	*Pounds.*	*Per cent.*	
2-inch sisal	Single knot tied in its own part.	2,925	1,740	59	
Do		2,925	2,020	69	Wet knot.
2-inch manila		3,775	2,310	61	
Do		3,775	3,120	88	Do.
2½-inch manila		6,207	2,980	48	
Do		6,207	4,310	69	Do.
4½-inch manila		19,577	9,950	51	
Do		19,577	12,900	66	Do.
9-thread sisal	Rolling hitch	605	534	88	
1½-inch sisal	do	1,397	1,175	85	
1½-inch sisal	do	2,067	1,664	80	
2½-inch manila	do	6,207	3,840	62	
Do	Cat's-paw	6,207	3,320	53	
3½-inch manila	2-eye splices	12,093	12,080	100	
Do	Short splice	12,093	10,430	86	
3½-inch manila	Shroud knot	14,640	9,120	62	
4-inch manila	Short splice	14,723	11,420	78	
Do	do	.....	14,800	.....	4 strand.
5-inch manila	Single Garrick bend	23,360	11,700	50	
6-inch manila	do	31,570	17,100	54	
8-inch manila	Anchor knot	54,000	50,300	93	
8½-inch manila	Short splice	58,040	47,400	80	

The varying amount of moisture held by ropes was observed over a period of several months.

Short pieces, about 12 inches long each, were exposed to the air in a ventilated housing on the north side of a building, where the samples were protected from the direct effect of rain, but open to a circulation of air.

The samples varied in weight from day to day.

In the table appended are collected data showing the range in weights experienced during the period observed and the final weight after having been dried in a muffle at a temperature of about 212° F.

Tabulation showing the weights of ropes due to the varying amounts of moisture held by them during long exposure in the air.

Rope.	Feb. 11. Temperature, 57° F.; humidity, 42.5.	Mar. 3. Temperature, 44° F.; humidity, 82.		Mar. 25. Temperature, 40° F.; humidity, 50.		Apr. 2. Temperature, 56° F.; humidity, 23.		May 3. Temperature, 48° F.; humidity, 98.		May 20. Temperature, 68° F.; humidity, 43.		June 10. Temperature, 55° F.; humidity, 93.		After drying in muffle at temperature of 212° F.	
	Weight.	Weight.	Increase.	Weight.	Increase.	Weight.	Increase.	Weight.	Increase.	Weight.	Increase.	Weight.	Increase.	Weight.	Decrease.
	Grams.	*Grams.*	*Per cent.*	*Grams.*	*Per cent.*	*Grams.*	*Per cent.*	*Grams.*	*Per cent.*	*Grams.*	*Per cent.*	*Grams.*	*Per cent.*	*Grams.*	*Per cent.*
6½″ manila	288.91	302.90	4.84	307.94	6.59	295.58	2.29	308.40	6.74	295.73	2.36	313.23	8.42	274.38	5.08
4½″ manila	126.73	133.93	5.68	136.14	7.42	129.77	2.40	138.08	8.96	129.75	2.38	140.53	10.89	119.33	5.84
3½″ manila	98.09	104.36	6.39	105.89	7.95	100.28	2.23	106.44	8.51	100.28	2.23	108.44	10.55	92.28	5.92
3″ manila	62.13	65.91	6.08	66.67	7.31	62.80	1.08	67.29	8.32	62.74	.98	68.56	10.34	57.73	7.08
2½″ manila	39.41	41.21	4.57	42.82	8.65	39.99	1.47	43.34	9.97	39.98	1.44	44.17	12.07	37.87	3.91
2″ manila	31.52	33.88	7.49	34.35	8.98	31.99	1.49	34.74	10.21	31.99	1.49	35.52	12.69	29.52	6.34
1½″ manila	22.05	24.05	9.07	24.27	10.07	22.44	1.77	24.69	11.97	22.42	1.68	25.11	13.88	19.77	10.34
2½″ sisal	54.08	58.16	7.54	58.52	8.21	54.64	1.08	59.07	9.23	54.62	1.00	60.40	11.69	50.47	6.67
2½″ sisal	41.10	44.26	7.14	44.64	8.61	41.71	1.48	45.18	9.93	41.69	1.44	46.24	12.51	38.37	6.64
3″ hemp	235.49	240.75	2.23	242.49	2.97	238.21	1.15	243.19	3.26	238.19	1.15	245.90	4.42	224.23	4.78
2″ hemp	127.00	130.39	2.67	131.69	3.69	128.88	1.44	132.24	4.13	128.84	1.45	134.09	5.58	119.60	5.88
1″ hemp	49.83	51.65	3.65	52.07	4.49	50.69	1.72	52.34	5.04	50.66	1.66	53.27	6.90	46.69	6.30
½″ cotton	34.53	37.15	7.59	37.29	7.99	35.04	1.48	37.85	9.61	34.89	1.04	38.35	11.06	33.09	4.17
½″ cotton	25.50	27.50	7.84	27.55	8.04	25.84	1.33	28.08	10.12	25.87	1.45	28.44	11.53	24.36	4.47
½″ cotton	17.21	18.63	8.25	18.56	7.84	17.39	1.06	18.94	10.05	17.41	1.16	19.17	11.39	16.43	4.58

The contraction in length when wetted was observed upon ropes immersed in a tank of water. It appears that ropes continue to contract in length for a long period of time when in an unrestrained condition, contraction still being in progress after twenty-eight days' immersion.

Stresses were applied to ropes in the testing machine and the specimens then wetted. This wetting resulted in a slightly increased rate of elongation, excepting a very low load was on the rope at the time; that is, the immediate effect of wetting was to slightly diminish the tensile stress then acting, if the length of the rope remained unchanged in the meantime.

Ropes under prolonged stresses, loaded out of doors in a vertical position by means of suspended weights, contracted during rainy weather and raised the weights. Ropes appear to be sluggish in the development of contractile forces, and the first effect of wetting, as it appears from these observations, may not always be accompanied by diminution in length.

CORDAGE.

ELONGATION TESTS ON DRY AND WET ROPE.

No. 9157.

1¾″ MANILA ROPE.

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
50	.....	1.65	.....	
100	.....	2.04	.....	
150	.....	2.35	.....	
200	.....	2.67	.....	
300	.....	3.20	.....	
400	.....	3.69	.....	
500	.....	4.10	.....	
600	.....	4.43	.....	
700	.....	4.80	.....	
800	.....	5.17	.....	
900	.....	5.48	.....	
1,000	.....	5.85	.....	
1,200	.....	6.39	.....	
1,400	.....	6.81	.....	
1,600	.....	7.38	.....	
1,800	.....	7.76	.....	
2,000	.....	8.10	.....	
2,200	.....	8.53	.....	
2,400	.....	8.78	.....	
2,600	.....	.....	.....	Tensile strength.

Parted one strand at the eye-splice.

No. 9158.

1¾″ MANILA ROPE.

From same piece of rope as No. 9157.
Gauged length of 50″ laid off on dry rope.
Immersed in water 17 hours before testing, which caused the gauged length to contract 3″.
Tested wet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
50	.....	—1.88	.....	Gauged length at present 48″.12.
100	.....	—1.03	.....	
150	.....	— .02	.....	
200	.....	+ .84	.....	
300	.....	2.22	.....	
400	.....	3.07	.....	
500	.....	3.70	.....	
600	.....	4.22	.....	
700	.....	4.69	.....	
800	.....	4.99	.....	
900	.....	5.31	.....	
1,000	.....	5.59	.....	
1,200	.....	5.95	.....	
1,400	.....	6.30	.....	
1,600	.....	6.68	.....	
1,800	.....	7.03	.....	
2,000	.....	7.31	.....	
2,200	.....	7.54	.....	
2,400	.....	7.79	.....	
2,600	.....	7.95	.....	
2,800	.....	8.25	.....	
3,000	.....	8.35	.....	
3,200	.....	8.58	.....	
3,400	.....	.....	.....	Tensile strength.

Parted one strand at the eye-splice.

No. 9154.

2¼″ MANILA ROPE.—THREE STRANDS.

From Sewall & Day Mills.
Gauged length of 50″ laid off on dry rope.
Immersed in water 6 hours before testing, which caused the gauged length to contract 1″.98.
Circumference when rope was dry, 2″.49.
Circumference when rope was wet, 2″.79.
Tested wet.

Applied loads.		In guaged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
50	.....	—1.88	.....	Gauged length at present, 48″.12.
100	.....	—1.12	.....	
200	.....	+.30	.....	
300	.....	1.35	.....	
400	.....	2.20	.....	
500	.....	2.90	.....	
600	.....	3.46	.....	
700	.....	3.90	.....	
800	.....	4.27	.....	
900	.....	4.60	.....	
1,000	.....	4.91	.....	
1,200	.....	5.36	.....	
1,400	.....	5.79	.....	
1,600	.....	6.07	.....	
1,800	.....	6.31	.....	
2,000	.....	6.54	.....	
2,200	.....	6.74	.....	
2,400	.....	6.93	.....	
2,600	.....	7.11	.....	
2,800	.....	7.23	.....	
3,000	.....	7.38	.....	
3,200	.....	7.50	.....	
3,600	.....	7.72	.....	
4,000	.....	7.93	.....	
4,400	.....	8.20	.....	
4,800	.....	8.37	.....	
5,200	.....	8.51	.....	
5,600	.....	8.64	.....	
6,390	.....	.....	.....	Tensile strength.

Parted one strand at the eye splice.

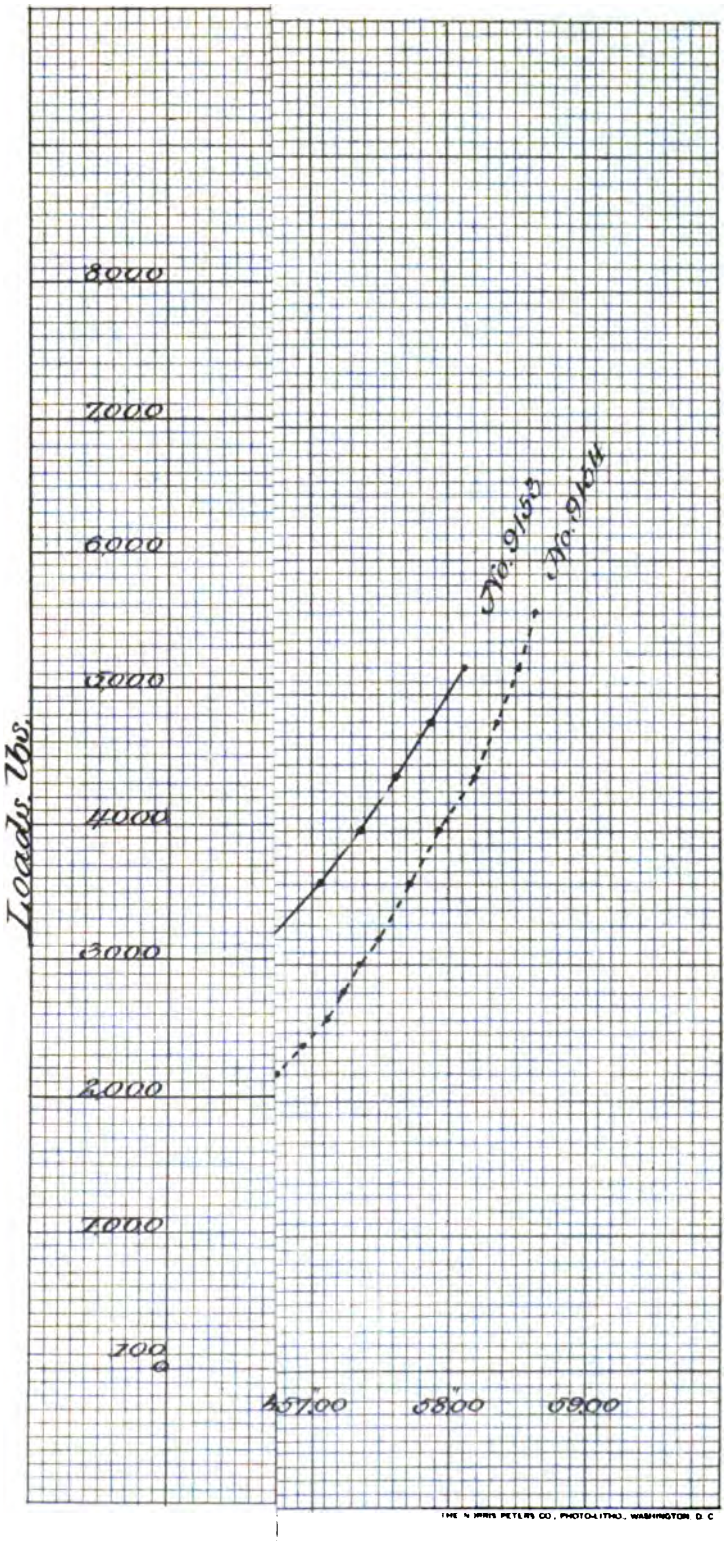
No. 9153.

2¼″ MANILA ROPE.—FOUR STRANDS.

From Sewall & Day Mills.
Gauged length of 50″ laid off on dry rope.
Immersed in water 5 hours before testing, which caused the gauged length to contract 1″.81.
Circumference when rope was dry, 2″.45.
Circumference when rope was wet, 2″.60.
Tested wet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
50	.....	—1.80	.....	Gauged length at present, 48″.20.
100	.....	—1.58	.....	
200	.....	— .72	.....	
300	.....	+ .03	.....	
400	.....	.63	.....	
500	.....	1.17	.....	
600	.....	1.52	.....	
700	.....	1.81	.....	
800	.....	2.02	.....	
900	.....	2.28	.....	
1,000	.....	2.50	.....	
1,200	.....	2.84	.....	
1,400	.....	3.20	.....	
1,600	.....	3.49	.....	
1,800	.....	3.90	.....	
2,000	.....	4.63	.....	
2,200	.....	5.21	.....	
2,400	.....	5.68	.....	
2,600	.....	6.08	.....	
2,800	.....	6.31	.....	
3,000	.....	6.51	.....	
3,200	.....	6.70	.....	
3,600	.....	7.08	.....	
4,000	.....	7.38	.....	
4,400	.....	7.63	.....	
4,800	.....	7.89	.....	
5,200	.....	8.11	.....	
5,520	.....	.....	.....	Tensile strength.

Parted one strand 43″ from the eye splice.



THE N. ARMS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 9151.

$2\frac{3}{4}$″ MANILA ROPE.

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
50	.....	0.79	.....	
100	.....	1.15	.....	
200	.....	1.74	.....	
300	.....	2.20	.....	
400	.....	2.59	.....	
500	.....	2.88	.....	
600	.....	3.12	.....	
700	.....	3.33	.....	
800	.....	3.59	.....	
900	.....	3.80	.....	
1,000	.....	3.98	.....	
800	.....	3.97	.....	
600	.....	3.90	.....	
400	.....	3.78	.....	
200	.....	3.58	.....	
100	.....	3.37	.....	
200	.....	3.40	.....	
400	.....	3.51	.....	
600	.....	3.69	.....	
800	.....	3.90	.....	
1,000	.....	4.09	.....	
1,400	.....	4.74	.....	
1,800	.....	5.40	.....	
2,000	.....	5.76	.....	
1,000	.....	5.55	.....	
100	.....	4.63	.....	
1,000	.....	5.19	.....	
2,000	.....	5.84	.....	
2,400	.....	6.32	.....	
2,800	.....	6.78	.....	
3,200	.....	7.20	.....	
3,600	.....	7.70	.....	
4,000	.....	7.95	.....	
2,000	.....	7.70	.....	
100	.....	6.50	.....	
2,000	.....	7.30	.....	
4,000	.....	8.05	.....	
4,400	.....	8.20	.....	
4,800	.....	8.48	.....	
5,200	.....	8.70	.....	
5,600	.....	8.98	.....	
6,000	.....	9.10	.....	
6,400	.....	9.32	.....	
6,800	.....	9.55	.....	
7,200	.....	9.68	.....	
8,860	.....	.....	.....	Tensile strength.

Parted one strand 3 feet from the eye splice.

No. 9152.

$2\frac{3}{4}$″ MANILA ROPE.

Taken from same piece of rope as No. 9151.
Gauged length of 50″ laid off on dry rope.
Immersed in water 4 hours before testing, which caused the gauged length to contract 1″.68.
Tested wet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
50	.....	−1.30	.....	Gauged length at present, 48″.70.
100	.....	− .91	.....	Gauged length at present, 49″.09.
200	.....	+ .14	.....	Gauged length at present, 50″.14.
300	.....	1.10	.....	
400	.....	1.84	.....	
500	.....	2.54	.....	
600	.....	3.02	.....	
700	.....	3.50	.....	
800	.....	3.89	.....	
900	.....	4.23	.....	
1,000	.....	4.56	.....	
800	.....	4.55	.....	
600	.....	4.43	.....	
400	.....	4.30	.....	
200	.....	4.01	.....	
100	.....	3.70	.....	
200	.....	3.73	.....	
400	.....	3.90	.....	
600	.....	4.12	.....	
800	.....	4.38	.....	
1,000	.....	4.74	.....	
1,400	.....	5.61	.....	
1,800	.....	6.33	.....	
2,000	.....	6.66	.....	
1,000	.....	6.43	.....	
100	.....	5.46	.....	
1,000	.....	6.07	.....	
2,000	.....	6.78	.....	
2,400	.....	7.18	.....	
2,800	.....	7.47	.....	
3,200	.....	7.77	.....	
3,600	.....	8.01	.....	
4,000	.....	8.20	.....	
2,000	.....	7.94	.....	
100	.....	6.84	.....	
2,000	.....	7.65	.....	
4,000	.....	8.23	.....	
4,400	.....	8.45	.....	
4,800	.....	8.58	.....	
5,200	.....	8.73	.....	
5,600	.....	8.92	.....	
6,000	.....	9.03	.....	
6,400	.....	9.16	.....	
6,800	.....	9.40	.....	
7,200	.....	9.52	.....	
100	.....	8.15	.....	
8,890	.....	.....	.....	Tensile strength.

Parted one strand at the eye splice.

No. 8826.

4″ MANILA ROPE.

From Sewall & Day Mills.
Eye splices at ends.
Gauged length of 50″ laid off, then rope immersed in water bath 4¾ hours.
Length between eye splices about 8 feet.
Tested wet.

Applied loads.	In gauged length.			Circumference.	Remarks.
	Total.	Elongation.	Set.		
Pounds.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	
200	49.00	0.	0.	4.60	Initial load.
400	50.28	1.28	.....	.....	
600	51.08	2.08	.....	.....	
800	51.65	2.65	.....	.....	
1,000	52.12	3.12	.....	.....	
1,500	52.98	3.98	.....	.....	
2,000	53.60	4.60	.....	4.07	
2,500	54.16	5.16	.....	.....	
3,000	54.52	5.52	.....	.....	
3,500	55.00	6.00	.....	.....	
4,000	55.30	6.30	.....	3.91	
4,500	55.60	6.60	.....	.....	
5,000	55.90	6.90	.....	.....	
5,500	56.10	7.10	.....	.....	
6,000	56.38	7.36	.....	3.77	
200	55.30	.....	6.30	4.00	
6,000	56.60	7.60	.....	.....	
7,000	56.86	7.86	.....	.....	
8,000	57.15	8.15	.....	3.72	
9,000	57.50	8.50	.....	.....	
10,000	57.70	8.70	.....	3.63	
200	56.30	.....	7.30	3.84	
0	.....	.....	.....	.....	
200	55.86	.....	6.86	.....	
400	55.95	6.95	.....	.....	
600	55.95	6.95	.....	.....	
800	56.05	7.05	.....	.....	
1,000	56.08	7.08	.....	.....	
1,500	56.26	7.26	.....	.....	
2,000	56.40	7.40	.....	.....	
2,500	56.50	7.50	.....	.....	
3,000	56.60	7.60	.....	.....	
3,500	56.73	7.73	.....	.....	
4,000	56.85	7.85	.....	.....	
4,500	56.92	7.92	.....	.....	
5,000	57.03	8.03	.....	.....	
6,000	57.20	8.20	.....	.....	
7,000	57.38	8.38	.....	.....	
8,000	57.53	8.53	.....	.....	
9,000	57.65	8.65	.....	.....	
10,000	57.80	8.80	.....	.....	
5,000	57.60	8.60	.....	.....	
4,000	57.53	8.53	.....	.....	
3,000	57.45	8.45	.....	.....	
2,000	57.28	8.28	.....	.....	
1,000	57.09	8.09	.....	.....	
200	56.60	.....	7.60	3.81	
16,190	.....	.....	.....	.....	Tensile strength.

Parted one strand at the splice.

No. 5825.

5″ MANILA ROPE.

From Sewall & Day Mills.
Eye-splices at ends.
Gauged length of 50″ laid off, then rope immersed in water bath 19½ hours.
Length between eye-splices, about 8 feet.
Tested wet.

Applied loads.	In gauged length.			Circumference.	Remarks.
	Total.	Elongation.	Set.		
Pounds.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	
200	48.00	0.	0.	5.83	Initial load.
400	49.05	1.05	.....	.....	
600	49.90	1.90	.....	.....	
800	50.75	2.75	.....	.....	
1,000	51.38	3.38	.....	.....	
1,500	52.50	4.50	.....	.....	
2,000	53.30	5.30	.....	5.25	
2,500	54.00	6.00	.....	.....	
3,000	54.40	6.40	.....	.....	
3,500	54.74	6.74	.....	.....	
4,000	55.10	7.10	.....	5.00	
4,500	55.43	7.43	.....	.....	
5,000	55.65	7.65	.....	.....	
5,500	55.80	7.80	.....	.....	
6,000	56.45	8.45	.....	4.83	
200	54.90	.....	6.90	5.09	
6,000	56.18	8.18	.....	.....	
7,000	56.45	8.45	.....	.....	
8,000	56.58	8.58	.....	4.80	
9,000	56.90	8.90	.....	.....	
10,000	57.10	9.10	.....	.....	
11,000	57.25	9.25	.....	.....	
12,000	57.40	9.40	.....	4.68	
13,000	57.58	9.58	.....	.....	
14,000	57.70	9.70	.....	.....	
15,000	57.88	9.88	.....	4.63	
200	56.50	.....	8.50	4.90	
0	.....	.....	.....	.....	
200	55.55	.....	7.55	.....	
400	55.70	7.70	.....	.....	
600	55.80	7.80	.....	.....	
800	55.95	7.95	.....	.....	
1,000	56.00	8.00	.....	.....	
1,500	56.18	8.18	.....	.....	
2,000	56.35	8.35	.....	.....	
2,500	56.48	8.48	.....	.....	
3,000	56.64	8.64	.....	.....	
3,500	56.75	8.75	.....	.....	
4,000	56.90	8.90	.....	.....	
4,500	56.96	8.96	.....	.....	
5,000	57.00	9.00	.....	.....	
6,000	57.13	9.13	.....	.....	
7,000	57.28	9.28	.....	.....	
8,000	57.37	9.37	.....	.....	
9,000	57.50	9.50	.....	.....	
10,000	57.58	9.58	.....	.....	
5,000	57.45	9.45	.....	.....	
4,000	57.32	9.32	.....	.....	
3,000	57.30	9.30	.....	.....	
2,000	57.22	9.22	.....	.....	
1,000	57.06	9.06	.....	.....	
200	56.70	.....	8.70	4.84	
23,180	.....	.....	.....	.....	Tensile strength.

Parted two strands at the splice.

No. 8821.

7″ MANILA ROPE.

From Sewall & Day mills.
Eye splices at ends.
Gauged length of 50″ laid off, then rope immersed in water bath 22 hours.
Length between eye-splices, about 8 feet.
Tested wet.

Applied loads.	In gauged length.			Circumference.	Remarks.
	Total.	Elongation.	Set.		
Pounds.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	
200	46.58	0.	0.	8.50	Initial load.
400	47.00	.42	.....	.....	
600	47.65	1.07	.....	.....	
800	48.33	1.75	.....	.....	
1,000	49.02	2.44	.....	.....	
1,500	50.15	3.57	.....	.....	
2,000	51.88	5.30	.....	7.84	
2,500	51.95	5.37	.....	.....	
3,000	52.55	5.97	.....	.....	
3,500	52.98	6.40	.....	.....	
4,000	53.46	6.88	.....	7.44	
4,500	53.80	7.22	.....	.....	
5,000	54.15	7.57	.....	.....	
5,500	54.38	7.80	.....	.....	
6,000	54.70	8.12	.....	7.22	
200	53.27	.....	6.69	7.61	
6,000	54.90	8.32	.....	.....	
7,000	55.18	8.60	.....	.....	
8,000	55.48	8.90	.....	7.05	
9,000	55.98	9.40	.....	.....	
10,000	56.13	9.55	.....	.....	
11,000	56.40	9.82	.....	.....	
12,000	56.59	10.01	.....	6.89	
13,000	56.90	10.32	.....	.....	
14,000	57.02	10.44	.....	.....	
15,000	57.20	10.62	.....	6.78	
16,000	57.40	10.82	.....	.....	
18,000	57.70	11.12	.....	.....	
20,000	57.90	11.32	.....	6.68	
200	56.28	.....	9.70	7.10	
0	.....	.....	.....	.....	
200	55.40	.....	8.82	.....	
400	55.50	8.92	.....	.....	
600	55.55	8.97	.....	.....	
800	55.60	9.02	.....	.....	
1,000	55.65	9.07	.....	.....	
1,500	55.80	9.22	.....	.....	
2,000	55.90	9.32	.....	.....	
2,500	56.00	9.42	.....	.....	
3,000	56.10	9.52	.....	.....	
3,500	56.20	9.62	.....	.....	
4,000	56.30	9.72	.....	.....	
4,500	56.40	9.82	.....	.....	
5,000	56.50	9.92	.....	.....	
6,000	56.66	10.08	.....	.....	
7,000	56.80	10.22	.....	.....	
8,000	56.93	10.35	.....	.....	
9,000	57.10	10.52	.....	.....	
0,000	57.20	10.62	.....	.....	
15,000	57.03	10.45	.....	.....	
4 000	57.00	10.42	.....	.....	
3,000	56.90	10.32	.....	.....	
2,000	56.80	10.22	.....	.....	
1,000	56.60	10.02	.....	.....	
200	56.17	.....	9.59	7.06	
4,750	.....	.....	.....	.....	Tensile strength.

Parted one strand at the splice.

No. 8818.

7½″ MANILA ROPE.

From Sewall & Day Mills.
Three strands of 140 threads each.
Actual circumference, 8″.15; diameter, 2″.64.
Lay, one turn in 6″.
Length between eye-splices, 8 feet 5 inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
Pounds.	*Pounds.*	*Inches.*	*Inches.*	*Inches.*	
0	.....	0.	.....	.....	
200	.....	1.50	.....	.....	
400	.....	2.25	.....	.....	
600	.....	2.50	.....	.....	
800	.....	2.75	.....	.....	
1,000	.....	3.10	.....	.....	
1,500	.....	3.50	.....	.....	
2,000	.....	3.90	.....	.....	
2,500	.....	4.15	.....	.....	
3,000	.....	4.35	.....	.....	
3,500	.....	4.60	.....	.....	
4,000	.....	4.75	.....	.....	
4,500	.....	4.90	.....	.....	
5,000	.....	5.10	.....	.....	
5,500	.....	5.25	.....	.....	
6,000	.....	5.40	.....	.....	
200	.....	4.25	.....	.....	
6,000	.....	5.50	.....	7.38	
7,000	.....	5.80	.....	.....	
8,000	.....	5.90	.....	7.19	
9,000	.....	6.20	.....	.....	
10,000	.....	6.40	.....	.....	
11,000	.....	6.60	.....	.....	
12,000	.....	6.75	.....	7.19	
13,000	.....	6.98	.....	.....	
14,000	.....	7.15	.....	.....	
15,000	.....	7.30	.....	.....	
16,000	.....	7.50	.....	7.01	
18,000	.....	7.80	.....	.....	
20,000	.....	8.15	.....	6.84	
200	.....	6.25	.....	7.22	
0	.....	.....	5.20	.....	
					Rested 1½ hours.
200	.....	5.00	.....	.....	
400	.....	5.20	.....	.....	
600	.....	5.32	.....	.....	
800	.....	5.40	.....	.....	
1,000	.....	5.50	.....	.....	
1,500	.....	5.60	.....	.....	
2,000	.....	5.90	.....	.....	
2,500	.....	6.04	.....	.....	
3,000	.....	6.20	.....	.....	
3,500	.....	6.25	.....	.....	
4,000	.....	6.38	.....	.....	
4,500	.....	6.50	.....	.....	
5,000	.....	6.53	.....	.....	
6,000	.....	6.72	.....	.....	
7,000	.....	6.83	.....	.....	
8,000	.....	6.92	.....	.....	
9,000	.....	7.10	.....	.....	
10,000	.....	7.18	.....	.....	
9,000	.....	7.20	.....	.....	
8,000	.....	7.15	.....	.....	
7,000	.....	7.15	.....	.....	
6,000	.....	7.06	.....	.....	
5,000	.....	7.03	.....	.....	
4,000	.....	6.98	.....	.....	
3,000	.....	6.93	.....	.....	
2,000	.....	6.80	.....	.....	
1,000	.....	6.60	.....	.....	
200	.....	.....	6.10	7.25	
49,400	.....	.....	.....	.....	Tensile strength.

Parted one strand at the splice.

No. 8822.

8″ MANILA ROPE.

From Sewall & Day Mills.
Eye-splices at ends.
Gauged length of 50″ laid off, then rope immersed in water bath 4½ hours.
Length between eye-splices about 8 feet.
Tested wet.

Applied loads.	In gauged length.			Circumference.	Remarks.
	Total.	Elongation.	Set.		
Pounds.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	
200	46.00	0.	0.	9.50	Initial load.
400	46.50	.50	.....	.....	
600	47.30	1.30	.....	.....	
800	48.00	2.00	.....	.....	
1,000	48.70	2.70	.....	.....	
1,500	49.78	3.78	.....	.....	
2,000	50.60	4.60	.....	8.82	
2,500	51.28	5.28	.....	.....	
3,000	51.70	5.70	.....	.....	
3,500	52.18	6.18	.....	.....	
4,000	52.70	6.70	.....	8.39	
4,500	53.00	7.00	.....	.....	
5,000	53.30	7.30	.....	.....	
5,500	53.58	7.58	.....	.....	
6,000	53.85	7.85	.....	8.11	
200	52.55	.....	6.55	8.80	
6,000	53.96	7.96	.....	.....	
7,000	54.27	8.27	.....	.....	
8,000	54.63	8.63	.....	8.00	
9,000	55.00	9.00	.....	.....	
10,000	55.30	9.30	.....	.....	
11,000	55.45	9.45	.....	.....	
12,000	85.62	9.62	.....	7.68	
13,000	55.88	9.88	.....	.....	
14,000	56.07	10.07	.....	.....	
15,000	56.20	10.20	.....	7.58	
16,000	56.45	10.45	.....	.....	
18,000	56.63	10.63	.....	.....	
20,000	56.88	10.88	.....	7.44	
200	55.20	.....	9.20	8.16	
0	.....	.....	.....	.....	
200	53.80	.....	7.80	.....	
400	54.00	8.00	.....	.....	
600	54.15	8.15	.....	.....	
800	54.25	8.25	.....	.....	
1,000	54.30	8.30	.....	.....	
1,500	54.55	8.55	.....	.....	
2,000	54.68	8.68	.....	.....	
2,500	54.78	8.78	.....	.....	
3,000	54.93	8.93	.....	.....	
3,500	55.10	9.10	.....	.....	
4,000	55.23	9.23	.....	.....	
4,500	55.35	9.35	.....	.....	
5,000	55.43	9.43	.....	.....	
6,000	55.60	9.60	.....	.....	
7,000	55.80	9.80	.....	.....	
8,000	55.98	9.98	.....	.....	
9,000	56.12	10.12	.....	.....	
10,000	56.25	10.25	.....	.....	
5,000	56.01	10.01	.....	.....	
4,000	56.00	10.00	.....	.....	
3,000	55.88	9.88	.....	.....	
2,000	55.78	9.78	.....	.....	
1,000	55.60	9.60	.....	.....	
200	55.15	.....	9.15	7.93	
51,480	.....	.....	.....	.....	Tensile strength.

Parted one strand at the splice.

No. 8819.

8½″ MANILA ROPE.

From Sewall & Day mills.
Three strands of 157 threads each.
Actual circumference, 8″.78; diameter, 2″.90.
Lay, one turn in 6″.80.
Length between eye-splices, 8 feet 2½ inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
Pounds.	*Pounds.*	*Inches.*	*Inches.*	*Inches.*	
0	0.	0.	0.	8.78	
200	.....	2.28	.....	.....	
400	.....	2.85	.....	.....	
600	.....	3.20	.....	.....	
800	.....	3.50	.....	.....	
1,000	.....	3.75	.....	.....	
1,500	.....	4.10	.....	.....	
2,000	.....	4.40	.....	8.03	
2,500	.....	4.60	.....	.....	
3,000	.....	4.80	.....	.....	
3,500	.....	4.93	.....	.....	
4,000	.....	5.10	.....	7.89	
4,500	.....	5.25	.....	.....	
5,000	.....	5.40	.....	.....	
5,500	.....	5.50	.....	.....	
6,000	.....	5.65	.....	7.78	
200	.....	4.40	.....	.....	
0	.....	.....	3.10	8.29	
6,000	.....	5.75	.....	.....	
7,000	.....	5.90	.....	.....	
8,000	.....	6.08	.....	7.61	
9,000	.....	6.25	.....	.....	
10,000	.....	6.40	.....	.....	
11,000	.....	6.53	.....	.....	
12,000	.....	6.70	.....	7.56	
13,000	.....	6.90	.....	.....	
14,000	.....	7.00	.....	.....	
15,000	.....	7.10	.....	7.43	
16,000	.....	7.25	.....	.....	
18,000	.....	7.50	.....	.....	
20,000	.....	7.72	.....	7.30	
200	.....	5.90	.....	7.72	
0	.....	.....	4.90	.....	
200	.....	5.10	.....	.....	
400	.....	5.43	.....	.....	
600	.....	5.70	.....	.....	
800	.....	5.80	.....	.....	
1,000	.....	5.90	.....	.....	
1,500	.....	6.03	.....	.....	
2,000	.....	6.20	.....	.....	
2,500	.....	6.22	.....	.....	
3,000	.....	6.38	.....	.....	
3,500	.....	6.42	.....	.....	
4,000	.....	6.50	.....	.....	
4,500	.....	6.55	.....	.....	
5,000	.....	6.62	.....	.....	
6,000	.....	6.73	.....	.....	
7,000	.....	6.85	.....	.....	
8,000	.....	6.95	.....	.....	
9,000	.....	7.05	.....	.....	
10,000	.....	7.13	.....	.....	
9,000	.....	7.10	.....	.....	
8,000	.....	7.18	.....	.....	
7,000	.....	7.10	.....	.....	
6,000	.....	7.08	.....	.....	
5,000	.....	7.02	.....	.....	
4,000	.....	7.00	.....	.....	
3,000	.....	6.93	.....	.....	
2,000	.....	6.88	.....	.....	

No. 8819—Continued.

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
Pounds.	*Pounds.*	*Inches.*	*Inches.*	*Inches.*	
1,000	.....	6.65	.....	.....	
200	.....	5.98	.....	.....	
0	.....	.....	5.37	.....	
.....	.....	.....	5.25	7.91	After resting 39½ hours.
200	.....	5.38	.....	.....	
400	.....	5.50	.....	.....	
600	.....	5.60	.....	.....	
800	.....	5.73	.....	.....	
1,000	.....	5.78	.....	.....	
1,500	.....	5.95	.....	.....	
2,000	.....	6.07	.....	.....	
2,500	.....	6.18	.....	.....	
3,000	.....	6.28	.....	.....	
3,500	.....	6.35	.....	.....	
4,000	.....	6.43	.....	.....	
4,500	.....	6.50	.....	.....	
5,000	.....	6.55	.....	.....	
6,000	.....	6.63	.....	.....	
7,000	.....	6.76	.....	.....	
8,000	.....	6.86	.....	.....	
9,000	.....	6.93	.....	.....	
10,000	.....	7.00	.....	.....	
9,000	.....	7.08	.....	.....	
8,000	.....	7.05	.....	.....	
7,000	.....	7.08	.....	.....	
6,000	.....	6.95	.....	.....	
5,000	.....	6.90	.....	.....	
4,000	.....	6.86	.....	.....	
3,000	.....	6.78	.....	.....	
2,000	.....	6.70	.....	.....	
1,000	.....	6.43	.....	.....	
200	.....	5.90	.....	.....	
0	.....	.....	5.35	.....	
55,250	.....	.....	.....	.....	Tensile strength.

Parted one strand at the splice.

No. 8823.

9″ MANILA ROPE.

From Sewall & Day mills.
Eye-splices at ends.
Gauged length of 50″ laid off, then rope immersed in water bath 19 hours.
Length between eye-splices about 8 feet.
Tested wet.

Applied loads.	In gauged length.			Circumference.	Remarks.
	Total.	Elongation.	Set.		
Pounds.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	
200	47.30	0.	0.	10.71	Initial load.
400	47.35	.55	.....	.....	
600	47.96	.66	.....	.....	
800	48.45	1.15	.....	.....	
1,000	48.70	1.40	.....	.....	
1,500	49.85	2.55	.....	.....	
2,000	50.65	3.35	.....	10.02	
2,500	51.40	4.10	.....	.....	
3,000	52.10	4.80	.....	.....	
3,500	52.80	5.30	.....	.....	
4,000	53.02	5.72	.....	9.70	
4,500	53.48	6.18	.....	.....	
5,000	53.80	6.50	.....	.....	
5,500	54.10	6.80	.....	.....	
6,000	54.40	7.10	.....	9.33	
200	52 90	.....	5.60	9.91	
6,000	54.50	7.20	.....	.....	
7,000	54.95	7.65	.....	.....	
8,000	55.35	8.05	.....	9.14	
9,000	55.70	8.40	.....	.....	
10,000	56.00	8.70	.....	.....	
11,000	56.20	8.90	.....	.....	
12,000	56.45	9.15	.....	8.92	
13,000	56.80	9.50	.....	.....	
14,000	56.96	9.66	.....	.....	
15,000	57.12	9.82	.....	8.74	
16,000	57.28	9.98	.....	.....	
18,000	57.50	10.20	.....	.....	
20,000	57.80	10.50	.....	8.58	
200	56.05	.....	8.75	9.22	
0	.....	.....	.....	.....	
200	55.00	.....	7.70	.....	
400	55.08	7.78	.....	.....	
600	55.15	7.85	.....	.....	
800	55.22	7.92	.....	.....	
1,000	55.35	8.05	.....	.....	
1,500	55 45	8.15	.....	.....	
2,000	55.60	8.30	.....	.....	
2,500	55.75	8.45	.....	.....	
3,000	55.86	8.56	.....	.....	
3,500	55.95	8.65	.....	.....	
4,000	56.05	8.75	.....	.....	
4,500	56.16	8.86	.....	.....	
5,000	56.28	8.98	.....	.....	
6,000	56.45	9.15	.....	.....	
7,000	56.60	9.30	.....	.....	
8,000	56.75	9.45	.....	.....	
9,000	56.90	9.60	.....	.....	
10,000	57.03	9.73	.....	.....	
5,000	56.90	9.60	.....	.....	
4,080	56.80	9.50	.....	.....	
3,000	56.70	9.40	.....	.....	
2,000	56.56	9.26	.....	.....	
1,000	56.38	9.08	.....	.....	
200	55.78	.....	8.48	9.24	
68,070	.....	.....	.....	.....	Tensile strength.

Parted one strand at the splice.

No. 8820.

9½″ MANILA ROPE.

From Sewall & Day Mills.
Three strands of 212 threads each.
Actual circumference, 10″.24; diameter 3″.45.
Lay, 1 turn in 7″ 40.
Length between eye splices 8 feet 6 inches.
Gauged length 50″.

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
Pounds.	*Pounds.*	*Inches.*	*Inches.*	*Inches.*	
0	0.	0.	0.	10.24	
200	.....	1.40	.....	.....	
400	.....	1.90	.....	.....	
600	.....	2.30	.....	.....	
800	.....	2.60	.....	.....	
1,000	.....	2.83	.....	.....	
1,500	.....	3.18	.....	.....	
2,000	.....	3.50	.....	9.52	
2,500	.....	3.85	.....	.....	
3,000	.....	3.98	.....	.....	
3,500	.....	4.15	.....	.....	
4,000	.....	4.35	.....	9.36	
4,500	.....	4.50	.....	.....	
5,000	.....	4.68	.....	.....	
5,500	.....	4.80	.....	.....	
6,000	.....	4.95	.....	9.22	
200	.....	3.95	.....	.....	
0	.....	.....	3.25	9.60	
.....	.....	.....	2.90	9.60	After resting 1 hour.
6,000	.....	5.04	.....	.....	
7,000	.....	5.25	.....	.....	
8,000	.....	5.47	.....	9.13	
9,000	.....	5.70	.....	.....	
10,000	.....	5.90	.....	.....	
11,000	.....	6.08	.....	.....	
12,000	.....	6.28	.....	9.01	
13,000	.....	6.33	.....	.....	
14,000	.....	6.50	.....	.....	
15,000	.....	6.65	.....	8.91	
16,000	.....	6.80	.....	.....	
18,000	.....	7.03	.....	.....	
20,000	.....	7.30	.....	8.76	
200	.....	5.60	.....	.....	
0	.....	.....	3.90	9.38	
200	.....	4.35	.....	.....	
400	.....	4.65	.....	.....	
600	.....	4.80	.....	.....	
800	.....	5.05	.....	.....	
1,000	.....	5.20	.....	.....	
1,500	.....	5.40	.....	.....	
2,000	.....	5.50	.....	.....	
2,500	.....	5.57	.....	.....	
3,000	.....	5.76	.....	.....	
3,500	.....	5.90	.....	.....	
4,000	.....	6.00	.....	.....	
4,500	.....	6.06	.....	.....	
5,000	.....	6.12	.....	.....	
6,000	.....	6.30	.....	.....	
7,000	.....	6.40	.....	.....	
8,000	.....	6.56	.....	.....	
9,000	.....	6.63	.....	.....	
10,000	.....	6.77	.....	.....	
9,000	.....	6.75	.....	.....	
8,000	.....	6.72	.....	.....	
7,000	.....	6.76	.....	.....	
6,000	.....	6.74	.....	.....	
5,000	.....	6.67	.....	.....	
4,000	.....	6.60	.....	.....	
3,000	.....	6.60	.....	.....	
2,000	.....	6.48	.....	.....	
1,000	.....	6.30	.....	.....	
200	.....	5.68	.....	.....	
0	.....	.....	5.00	9.38	
66,050	.....	.....	.....	.....	Tensile strength.

Parted one strand at the splice.

No. 8828.

3″ MANILA ROPE.

From Boston Navy-Yard.
Eye splices at ends.
Gauged length of 50″ laid off, then rope immersed in water bath 19 hours.
Length between eye splices about 8 feet.
Tested wet.

Applied loads.	In gauged length.			Circumference.	Remarks.
	Total.	Elongation.	Set.		
Pounds.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	
200	48.90	0.	0.	3.60	Initial load.
400	50.13	1.23	.....	.....	
600	51.30	2.40	.....	.....	
800	52.30	3.40	.....	.....	
1,000	53.00	4.10	.....	.....	
1,500	54.20	5.30	.....	.....	
2,000	55.00	6.10	.....	3.08	
2,500	55.00	6.10	.....	.....	
3,000	55.98	7.08	.....	.....	
3,500	56.30	7.40	.....	.....	
4,000	56.68	7.78	.....	3.00	
4,500	56.90	8.00	.....	.....	
5,000	57.05	8.15	.....	.....	
5,500	57.28	8.38	.....	.....	
6,000	57.42	8.52	.....	2.93	
200	56.30	.....	7.40	3.02	
6,000	57.60	8.70	.....	.....	
7,000	57.86	8.96	.....	.....	
8,000	58.10	9.20	.....	2.90	
200	56.80	.....	7.90	2.97	
0	.....	.....	.....	.....	
200	56.17	.....	7.27	.....	
400	56.27	7.37	.....	.....	
600	56.30	7.40	.....	.....	
800	56.48	7.58	.....	.....	
1,000	56.58	7.68	.....	.....	
1,500	56.72	7.82	.....	.....	
2,000	56.90	8.00	.....	.....	
2,500	57.10	8.20	.....	.....	
3,000	57.20	8.30	.....	.....	
3,500	57.33	8.43	.....	.....	
4,000	57.42	8.52	.....	.....	
4,500	57.56	8.66	.....	.....	
5,000	57.66	8.76	.....	.....	
4,000	57.63	8.73	.....	.....	
3,000	57.50	8.60	.....	.....	
2,000	57.35	8.45	.....	.....	
1,000	57.17	8.27	.....	.....	
200	56.85	.....	7.95	2.98	
10,500	.....	.....	.....	.....	Tensile strength.

Parted one strand at the splice.

No. 8725.

4″ MANILA ROPE.

Boston Navy-Yard manufacture.
Eye splices at ends.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
200	.....	1.03	.....	
400	.....	1.68	.....	
600	.....	2.14	.....	
800	.....	2.58	.....	
1,000	.....	3.03	.....	
2,000	.....	4.52	.....	
3,000	.....	5.46	.....	Rested 16 hours under stress between 3,000 and 2,400 pounds.
4,000	.....	6.50	.....	
5,000	.....	6.74	.....	
6,000	.....	7.13	.....	
7,000	.....	7.67	.....	
8,000	.....	8.27	.....	
9,000	.....	8.84	.....	
10,000	.....	9.27	.....	
11,000	.....	9.62	.....	
12,000	.....	10.00	.....	
6,000	.....	9.69	.....	
12,000	.....	10.07	.....	
6,000	.....	9.77	.....	
1,000	.....	9.11	.....	

No. 8827.

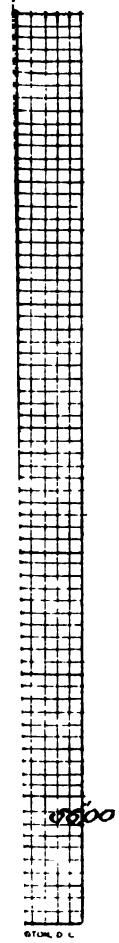
4″ MANILA ROPE.

From Boston Navy-Yard.
Eye-splices at ends.
Gauged length of 50″ laid off, then rope immersed in water bath 5¾ hours.
Length between eye-splices, about 8 feet.
Tested wet.

Applied loads.	In gauged length.			Circumference.	Remarks.
	Total.	Elongation.	Set.		
Pounds.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	
200	49.35	.....	.....	4.30	Initial load
400	50.20	.85	.....	.....	
600	50.88	1.53	.....	.....	
800	51.36	2.01	.....	.....	
1,000	51.87	2.52	.....	.....	
1,500	52.86	3.51	.....	.....	
2,000	53.60	4.25	.....	3.96	
2,500	54.07	4.72	.....	.....	
3,000	54.60	5.25	.....	.....	
3,500	54.97	5.62	.....	.....	
4,000	55.30	5.95	.....	3.78	
4,500	55.65	6.30	.....	.....	
5,000	56.05	6.70	.....	.....	
5,500	56.26	6.91	.....	.....	
6,000	56.58	7.23	.....	3.68	
200	55.46	.....	6.11	3.91	
6,000	56.80	7.45	.....	.....	
7,000	57.05	7.70	.....	.....	
8,000	57.25	7.90	.....	3.60	
9,000	57.68	8.33	.....	.....	
10,000	57.90	8.55	.....	3.52	
200	56.58	.....	7.23	3.72	
0	.....	.....	.....	.....	Rested 15½ hours.
200	55.05	.....	5.70	.....	
400	55.20	5.85	.....	.....	
600	55.30	5.95	.....	.....	
800	55.48	6.13	.....	.....	
1,000	55.60	6.25	.....	.....	
1,500	55.90	6.55	.....	.....	
2,000	56.18	6.83	.....	.....	
2,500	56.40	7.05	.....	.....	
3,000	56.58	7.23	.....	.....	
3,500	56.76	7.41	.....	.....	
4,000	56.90	7.55	.....	.....	
4,500	57.10	7.75	.....	.....	
5,000	57.24	7.89	.....	.....	
6,000	57.50	8.15	.....	.....	
7,000	57.70	8.35	.....	.....	
8,000	57.90	8.55	.....	.....	
9,000	58.10	8.75	.....	.....	
10,000	58.30	8.95	.....	.....	
5,000	58.05	8.70	.....	.....	
4,000	57.98	8.63	.....	.....	
3,000	57.92	8.57	.....	.....	
2,000	57.80	8.45	.....	.....	
1,000	57.63	8.28	.....	.....	
200	57.27	.....	7.92	3.61	
17,780	.....	.....	.....	.....	Tensile strength.

Parted one strand 9″.50 from splice.

8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No. 9159.

4″ MANILA ROPE.—FOUR STRANDS.

From Boston Navy-Yard.
Gauged length, 50″.
Test began on dry rope, continued on wet rope, and finally completed on dry rope.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
100		.95		
300		1.56		
400		1.76		
600		2.15		
800		2.35		
1,000		2.52		
1,500		2.91		
2,000		3.16		
3,000		3.59		
4,000		3.91		
5,000		4.22		
5,000		4.31		After 1 minute.
5,000		4.38		After 2 minutes.
5,000		4.39		After 3 minutes.
5,000		4.57		After 1 hour.
5,000		4.58		After 1 hour and 20 minutes.
4,000		4.54		
2,000		4.33		
1,000		4.19		
100		3.39		
0			1.80	Removed from testing machine and immersed in water.
				Gauged length after 1 hour immersion, 46″.92; thus showing a contraction of 3″.08 from the original gauged length and (3″.08 + 1″.80) = 4″.88 from the gauged length at the close of first test.
				Again placed in the testing machine.
100		—3.12		Gauged length at present, 46″.88.
200		—2.60		
300		—2.11		
400		—1.68		
500		—1.28		
600		— .91		
700		— .58		
800		— .32		
900		— .06		
1,000		+ .15		
1,100		.45		
1,200		.57		
1,500		.94		
2,000		1.59		
3,000		2.21		
4,000		2.81		
5,000		3.25		
5,000		3.39		After 1 minute.
5,000		3.49		After 2 minutes.
5,000		3.59		After 3 minutes.
4,000		3.51		
3,000		3.43		
2,000		3.28		
1,000		3.06		
100		2.30		
0			.28	Immediate set.
			.10	Set after 5 minutes.
				Removed from the testing machine and again immersed in water. After 17 hours immersion the gauged length measured 45″.89, thus showing a contraction of 4″.11 from the original length.
				Again placed in the testing machine.
100		—4.26		Gauged length at present, 45″.74.

No. 9159—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
200	.....	—4.05	.....	Elongation measured after sustaining load 15 minutes.
300	.....	—3.81	.....	
400	.....	—3.52	.....	
500	.....	—3.17	.....	
600	.....	—2.65	.....	
700	.....	—2.33	.....	
800	.....	—2.10	.....	
900	.....	—1.76	.....	
1,000	.....	—1.52	.....	
1,100	.....	—1.28	.....	
1,200	.....	—1.07	.....	
1,300	.....	— .82	.....	
1,400	.....	— .68	.....	
1,500	.....	— .53	.....	
1,600	.....	— .30	.....	
1,700	.....	— .08	.....	
1,800	.....	+ .06	.....	
1,900	.....	+ .23	.....	
2,000	.....	.32	.....	
2,500	.....	.65	.....	
3,000	.....	1.05	.....	
4,000	.....	1.72	.....	
5,000	.....	2.21	.....	
5,000	.....	2.38	.....	After 1 minute.
5,000	.....	2.48	.....	After 2 minutes.
5,000	.....	2.54	.....	After 3 minutes.
4,000	.....	2.48	.....	
3,000	.....	2.36	.....	
2,000	.....	2.13	.....	
1,000	.....	2.00	.....	
100	.....	1.22	.....	
0	.....	.....	—1.27	Test discontinued. Rope removed from testing machine and allowed to dry in the open air a period of 24 hours. At the end of 24 hours the gauged length measured 48″.21, thus showing a contraction of 1″.79. Again placed in the testing machine.
100	.....	— .47	.....	Gauged length at present, 49″.53.
200	.....	+ .09	.....	
300	.....	.29	.....	
400	.....	.53	.....	
600	.....	.95	.....	
800	.....	1.30	.....	
1,000	.....	1.55	.....	
1,500	.....	2.17	.....	
2,000	.....	2.51	.....	
3,000	.....	3.17	.....	
4,000	.....	3.59	.....	
5,000	.....	3.96	.....	
5,000	.....	4.05	.....	After 1 minute.
5,000	.....	4.10	.....	After 2 minutes.
5,000	.....	4.18	.....	After 3 minutes.
6,000	.....	4.29	.....	
7,000	.....	4.51	.....	
8,000	.....	4.71	.....	
9,000	.....	4.95	.....	
10,000	.....	5.17	.....	
12,000	.....	5.37	.....	
14,000	.....	5.69	.....	
15,980	.....	.....	.....	Tensile strength.

Parted one strand at the eye-splice.

No. 8824.

6″ MANILA ROPE.

From Boston Navy-Yard.
Eye-splices at ends.
Gauged length of 50″ laid off, then rope immersed in water bath 5½ hours.
Length between eye-splices about 8 feet.
Tested wet.

Applied loads.	In gauged length.			Circumference.	Remarks.
	Total.	Elongation.	Set.		
Pounds.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	
200	48.90	0.	0.	6.86	Initial load.
400	49.20	.30	.....	.....	
600	49.70	.80	.....	.....	
800	50.09	1.19	.....	.....	
1,000	50.55	1.65	.....	.....	
1,500	51.30	2.40	.....	.....	
2,000	51.90	3.00	.....	6.50	
2,500	52.40	3.50	.....	.....	
3,000	52.80	3.90	.....	.....	
3,500	53.23	4.33	.....	.....	
4,000	53.58	4.68	.....	6.30	
4,500	53.95	5.05	.....	.....	
5,000	54.20	5.30	.....	.....	
5,500	54.50	5.60	.....	.....	
6,000	54.78	5.88	.....	6.11	
200	53.55	.....	4.65	6.41	
6,000	54.98	6.08	.....	.....	
7,000	55.30	6.40	.....	.....	
8,000	55.70	6.80	.....	5.99	
9,000	56.10	7.20	.....	.....	
10,000	56.38	7.48	.....	.....	
11,000	56.58	7.68	.....	.....	
12,000	56.96	8.06	.....	5.84	
13,000	57.20	8.30	.....	.....	
14,000	57.35	8.45	.....	.....	
15,000	57.60	8.70	.....	5.74	
200	55.70	.....	6.80	6.13	
0	.....	.....	.....	.....	
200	54.75	.....	5.85	.....	
400	54.70	5.80	.....	.....	
600	54.80	5.90	.....	.....	
800	54.96	6.06	.....	.....	
1,000	55.00	6.10	.....	.....	
1,500	55 28	6.38	.....	.....	
2,000	55.53	6.63	.....	.....	
2,500	55.68	6.78	.....	.....	
3,000	55.85	6.95	.....	.....	
3,500	56.00	7.10	.....	.....	
4,000	56.12	7.22	.....	.....	
4,500	56.20	7.30	.....	.....	
5,000	56.30	7.40	.....	.....	
6,000	56.50	7.60	.....	.....	
7,000	56.75	7.85	.....	.....	
8,000	56.85	7.95	.....	.....	
9,000	57.00	8.10	.....	.....	
10,000	57.15	8.25	.....	.....	
5,000	57.00	8.10	.....	.....	
4,000	56.94	8.04	.....	.....	
3,000	56.85	7.95	.....	.....	
2,000	56.70	7.80	.....	.....	
1,000	56.50	7.60	.....	.....	
200	55.90	.....	7.00	6.09	
33,900	.....	.....	.....	.....	Tensile strength.

Parted one strand 2 feet 6 inches from splice.

No. 9163.

6″ MANILA ROPE.

From Boston Navy-Yard.
Gauged length, 30″.
Test began on dry rope; completed on wet rope.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
100	.....	.47	.....	
200	.....	.62	.....	
400	.....	.94	.....	
600	.....	1.18	.....	
800	.....	1.31	.....	
1,000	.....	1.47	.....	
2,000	.....	2.00	.....	
1,000	.....	1.97	.....	
2,000	.....	2.01	.....	
1,000	.....	1.94	.....	
2,000	.....	2.05	.....	
3,000	.....	2.38	.....	
2,000	.....	2.38	.....	
3,000	.....	2.41	.....	
2,000	.....	2.41	.....	
3,000	.....	2.48	.....	
2,000	.....	2.42	.....	
3,000	.....	2.49	.....	
4,000	.....	2.78	.....	
3,000	.....	2.75	.....	
4,000	.....	2.82	.....	
3,000	.....	2.78	.....	
4,000	.....	2.84	.....	
3,000	.....	2.80	.....	
4,000	.....	2.84	.....	
5,000	.....	3.07	.....	
4,000	.....	3.01	.....	
5,000	.....	3.11	.....	
4,000	.....	3.10	.....	
5,000	.....	3.14	.....	
6,000	.....	3.30	.....	
5,000	.....	3.26	.....	
6,000	.....	3.32	.....	
5,000	.....	3.32	.....	
6,000	.....	3.33	.....	
7,000	.....	3.50	.....	
6,000	.....	3.48	.....	
7,000	.....	3.52	.....	
6,000	.....	3.51	.....	
7,000	.....	3.55	.....	
8,000	.....	3.73	.....	
7,000	.....	3.70	.....	
8,000	.....	3.79	.....	
7,000	.....	3.75	.....	
8,000	.....	3.81	.....	
9,000	.....	3.90	.....	
8,000	.....	3.88	.....	Rested 2 hours; load in the meantime fell to 5,900 pounds.
9,000	.....	3.99	.....	
8,000	.....	3.99	.....	
9,000	.....	4.02	.....	
10,000	.....	4.05	.....	
9,000	.....	4.05	.....	
10,000	.....	4.10	.....	
9,000	.....	4.09	.....	
8,000	.....	4.08	.....	
7,000	.....	4.06	.....	
6,000	.....	4.00	.....	
5,000	.....	3.96	.....	
4,000	.....	3.92	.....	
3,000	.....	3.87	.....	
2,000	.....	3.79	.....	
1,000	.....	3.66	.....	
100	.....	3.13	.....	
1.000	.....	3.28	.....	

No. 9163—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
2,000	.....	3.44	.....	
3,000	.....	3.60	.....	
4,000	.....	3.69	.....	
5,000	.....	3.79	.....	
6,000	.....	3.84	.....	
7,000	.....	3.93	.....	
8,000	.....	4.00	.....	
9,000	.....	4.07	.....	
10,000	.....	4.16	.....	
12,000	.....	4.27	.....	
14,000	.....	4.50	.....	
16,000	.....	4.78	.....	
18,000	.....	5.18	.....	
20,000	.....	5.48	.....	
18,000	.....	5.48	.....	
20,000	.....	5.58	.....	
18,000	.....	5.60	.....	
20,000	.....	5.63	.....	
18,000	.....	5.62	.....	
16,000	.....	5.60	.....	
14,000	.....	5.58	.....	
12,000	.....	5.57	.....	
10,000	.....	5.49	.....	
8,000	.....	5.44	.....	
6,000	.....	5.33	.....	
4,000	.....	5.24	.....	
2,000	.....	5.09	.....	
1,000	.....	4.91	.....	
100	.....	4.49	.....	
0	.....	.....	2.90	Test discontinued. Rope immersed in water for a period of 16 hours. Gauged length after immersion 29″.77, hence total contraction due to wetting 3″.13. Rope returned to the testing machine and test resumed with wet rope.
100	.....	— .13	.....	Gauged length at present, 29″.87.
200	.....	— .05	.....	
400	.....	+ .02	.....	
600	.....	.32	.....	
800	.....	.61	.....	
1,000	.....	.84	.....	
1,200	.....	1.07	.....	
1,400	.....	1.27	.....	
2,000	.....	1.72	.....	
3,000	.....	2.35	.....	
4,000	.....	2.82	.....	
4,000	.....	3.07	.....	After 5 minutes.
100	.....	2.26	.....	
0	.....	.....	.....	New stroke of piston taken.
4,000	.....	2.97	.....	
5,000	.....	3.21	.....	
6,000	.....	3.50	.....	
7,000	.....	3.71	.....	
8,000	.....	3.91	.....	
9,000	.....	4.13	.....	
10,000	.....	4.36	.....	
12,000	.....	4.56	.....	
14,000	.....	4.85	.....	
16,000	.....	5.04	.....	
18,000	.....	5.20	.....	
20,000	.....	5.39	.....	
18,000	.....	5.34	.....	
20,000	.....	5.45	.....	
18,000	.....	5.45	.....	
20,000	.....	5.51	.....	
18,000	.....	5.49	.....	
16,000	.....	5.47	.....	
14,000	.....	5.39	.....	
12,000	.....	5.33	.....	
10,000	.....	5.30	.....	
8,000	.....	5.26	.....	
6,000	.....	5.18	.....	
4,000	.....	5.10	.....	
2,000	.....	4.98	.....	

No. 9163—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
1,000	.....	4.80	.....	
100	.....	4.25	.....	
1,000	.....	4.33	.....	
2,000	.....	4.45	.....	
4,000	.....	4.63	.....	
6,000	.....	4.83	.....	
8,000	.....	4.97	.....	
10,000	.....	5.08	.....	
12,000	.....	5.17	.....	
14,000	.....	5.26	.....	
16,000	.....	5.38	.....	
18,000	.....	5.45	.....	
20,000	.....	5.54	.....	
22,000	.....	5.63	.....	
24,000	.....	5.80	.....	
26,000	.....	5.91	.....	
28,000	.....	6.09	.....	
30,000	.....	.....	.....	Tensile strength.

Parted one strand, 10 inches from eye splice.

No. 9155.

HEMP ROPE.

Three strands.
Fourteen threads per strand.
Circumference, 1″.68.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
50	.....	1.06	.....	
100	.....	1.53	.....	
150	.....	1.91	.....	
200	.....	2.27	.....	
300	.....	2.78	.....	
400	.....	3.29	.....	
500	.....	3.60	.....	
600	.....	3.95	.....	
800	.....	4.37	.....	
1,000	.....	4.92	.....	
800	.....	4.90	.....	
600	.....	4.86	.....	
400	.....	4.78	.....	
200	.....	4.60	.....	
100	.....	4.40	.....	
200	.....	4.58	.....	
400	.....	4.64	.....	
600	.....	4.83	.....	
800	.....	5.00	.....	
1,000	.....	5.20	.....	
1,200	.....	5.36	.....	
1,400	.....	5.60	.....	
1,600	.....	5.73	.....	
1,800	.....	5.95	.....	
2,000	.....	6.15	.....	
2,400	.....	6.50	.....	Tensile strength.

Parted one strand 13″ from eye splice.

No. 9156.

HEMP ROPE.

Circumference, 1″.68.
Taken from same piece as No. 9155.
Gauged length of 50″ laid off on dry rope.
Immersed in water 16 hours before testing, which caused the gauged length to contract 1″.57.
Tested wet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
50	.....	—1.00	.....	Gauged length at present 49″.
100	.....	— .23	.....	
150	.....	+ .61	.....	
200	.....	1.03	.....	
300	.....	1.82	.....	
400	.....	2.31	.....	
500	.....	2.80	.....	
600	.....	3.15	.....	
800	.....	3.62	.....	
1,000	.....	3.97	.....	
800	.....	3.95	.....	
600	.....	3.87	.....	
400	.....	3.73	.....	
200	.....	3.54	.....	
100	.....	3.39	.....	
200	.....	3.45	.....	
400	.....	3.61	.....	
600	.....	3.80	.....	
800	.....	3.94	.....	
1,000	.....	4.12	.....	
1,200	.....	4.36	.....	
1,400	.....	4.54	.....	
1,600	.....	4.76	.....	
1,800	.....	5.02	.....	
2,000	.....	5.15	.....	
2,200	.....	5.40	.....	
2,400	.....	5.53	.....	
2,600	.....	5.69	.....	
2,800	.....	5.97	.....	Tensile strength.

Parted one strand 26″ from the eye splice.

No. 9160.

HEMP ROPE.

Circumference, 3″.23; diameter, 1″.06.
Three strands of 21 threads each.
Lay, 1 turn in 2″.75.
New rope; has been in store 12 years.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
100	.....	1.00	.....	
200	.....	1.52	.....	
300	.....	1.89	.....	
400	.....	2.16	.....	
500	.....	2.44	.....	
600	.....	2.74	.....	
700	.....	3.00	.....	
800	.....	3.22	.....	
900	.....	3.45	.....	
1,000	.....	3.72	.....	
500	.....	3.62	.....	
100	.....	3.36	.....	
500	.....	3.53	.....	
1,000	.....	3.87	.....	
1,200	.....	4.12	.....	
1,400	.....	4.38	.....	
1,600	.....	4.64	.....	
1,800	.....	4.83	.....	
2,000	.....	5.10	.....	
1,000	.....	4.97	.....	
500	.....	4.83	.....	
100	.....	4.52	.....	
500	.....	4.64	.....	
1,000	.....	4.80	.....	
2,000	.....	5.27	.....	
2,400	.....	5.50	.....	
2,800	.....	5.79	.....	
3,200	.....	6.08	.....	
3,600	.....	6.35	.....	
4,000	.....	6.50	.....	
2,000	.....	6.34	.....	
1,000	.....	6.20	.....	
500	.....	6.03	.....	
100	.....	5.73	.....	
100	.....	5.68	.....	After 2 minutes.
500	.....	5.73	.....	
1,000	.....	5.86	.....	
2,000	.....	6.14	.....	
4,000	.....	6.69	.....	
5,000	.....	6.86	.....	
6,000	.....	7.19	.....	
7,000	.....	7.44	.....	
8,000	.....	7.68	.....	
9,000	.....	.....	.....	Tensile strength.

Parted two strands at the eye splice.

No. 9161.

HEMP ROPE.

Taken from same piece of rope as No. 9160.
Gauged length of 50″ laid off on dry rope.
Immersed in water 45 minutes before testing, which caused the gauged length to contract ″.32.
Tested wet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
100	.....	+.28	.....	
200	.....	.80	.....	
300	.....	1.26	.....	
400	.....	1.76	.....	
500	.....	2.15	.....	
600	.....	2.50	.....	
700	.....	2.78	.....	
800	.....	3.00	.....	
900	.....	3.28	.....	
1,000	.....	3.47	.....	
500	.....	3.34	.....	
100	.....	3.00	.....	
500	.....	3.21	.....	
1,000	.....	3.55	.....	
1,200	.....	3.80	.....	
1,400	.....	4.14	.....	
1,600	.....	4.42	.....	
1,800	.....	4.58	.....	
2,000	.....	4.90	.....	
1,000	.....	4.78	.....	
500	.....	4.60	.....	
100	.....	4.29	.....	
500	.....	4.38	.....	
1,000	.....	4.57	.....	
2,000	.....	5.01	.....	
2,400	.....	5.28	.....	
2,800	.....	5.49	.....	
3,200	.....	5.73	.....	
3,600	.....	5.93	.....	
4,000	.....	6.17	.....	
2,000	.....	5.98	.....	
1,000	.....	5.77	.....	
500	.....	5.60	.....	
100	.....	5.30	.....	
500	.....	5.38	.....	
1,000	.....	5.55	.....	
2,000	.....	5.79	.....	
4,000	.....	6.27	.....	
5,000	.....	6.58	.....	
6,000	.....	6.83	.....	
7,000	.....	7.01	.....	
8,000	.....	7.32	.....	
9,000	.....	7.55	.....	
9,540	.....	.....	.....	Tensile strength.

Parted two strands 5″ from the eye splice.

No. 9162.

HEMP ROPE.

Taken from same piece as No. 9160.
Gauged length of 50″ laid off on dry rope.
Immersed in water 16 hours, which caused the gauged length to contract 1″.47.
Tested wet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
100	.....	+.10	.....	
200	.....	.81	.....	
300	.....	1.60	.....	
400	.....	2.30	.....	
500	.....	2.89	.....	
600	.....	3.47	.....	
700	.....	3.77	.....	
800	.....	4.02	.....	
900	.....	4.18	.....	
1,000	.....	4.32	.....	
500	.....	4.19	.....	
100	.....	3.67	.....	
500	.....	3.96	.....	
1,000	.....	4.36	.....	
1,200	.....	4.55	.....	
1,400	.....	4.72	.....	
1,600	.....	4.90	.....	
1,800	.....	5.11	.....	
2,000	.....	5.30	.....	
1,000	.....	5.12	.....	
500	.....	4.96	.....	
100	.....	4.69	.....	
500	.....	4.80	.....	
1,000	.....	4.92	.....	
2,000	.....	5.31	.....	
2,400	.....	5.51	.....	
2,800	.....	5.71	.....	
3,200	.....	5.89	.....	
3,600	.....	6.07	.....	
4,000	.....	6.28	.....	
2,000	.....	6.10	.....	
1,000	.....	5.86	.....	
500	.....	5.69	.....	
100	.....	5.52	.....	
500	.....	5.58	.....	
1,000	.....	5.70	.....	
2,000	.....	5.98	.....	
4,000	.....	6.38	.....	
5,000	.....	6.59	.....	
6,000	.....	6.86	.....	
7,000	.....	7.20	.....	
8,000	.....	7.50	.....	Tensile strength.

Parted two strands at the eye splice.

No. 9149.

1¼″ Sisal Rope.

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
50	.....	1.19	.....	
100	.....	1.74	.....	
200	.....	2.13	.....	
300	.....	2.70	.....	
400	.....	3.09	.....	
500	.....	3.49	.....	
600	.....	3.96	.....	
700	.....	4.24	.....	
800	.....	4.65	.....	
900	.....	5.04	.....	
1,000	.....	5.40	.....	
		5.62	.....	After 2 minutes.
1,100	.....	5.84	.....	
1,200	.....	6.20	.....	
1,300	.....	6.50	.....	
1,400	.....	6.76	.....	
1,500	.....	7.05	.....	
1,600	.....	7.40	.....	
1,695	.....	.....	.....	Tensile strength.

Parted one strand at the eye-splice.

No. 9150.

1¼″ Sisal Rope.

From same piece as No. 9149.
Gauged length of 50″ laid off on rope when dry.
Immersed in water 3 hours before testing.
Tested wet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
50	.....	—1.00	.....	Gauged length at present, 49″.
100	.....	+ .15	.....	Gauged length at present, 50″.15.
150	.....	1.13	.....	
200	.....	1.89	.....	
300	.....	3.28	.....	
400	.....	4.10	.....	
500	.....	4.66	.....	
600	.....	5.24	.....	
700	.....	5.70	.....	
800	.....	6.20	.....	
900	.....	6.67	.....	
1,000	.....	7.02	.....	
1,100	.....	7.40	.....	
1,200	.....	7.79	.....	
1,258	.....	.....	.....	Tensile strength.

Parted one strand 26″ from eye-splice.

No. 8829.

3″ SISAL ROPE.

From Sewall & Day mills.
Eye-splices at ends.
Gauged length of 50″ laid off; then rope immersed in water bath 19 hours.
Length between eye-splices about 8 feet.
Tested wet.

Applied loads.	In gauged length.			Circumference.	Remarks.
	Total.	Elongation.	Set.		
Pounds.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	
200	48.50	0.	.0	3.45	Initial load.
400	49.80	1.30	.....	.....	
600	51.10	2.60	.....	.....	
800	51.93	3.43	.....	.....	
1,000	53.00	4.50	.....	.....	
1,500	54.20	5.70	.....	.....	
2,000	55.20	6.70	.....	2.90	
2,500	55.83	7.33	.....	.....	
3,000	56.45	7.95	.....	.....	
200	55.00	.....	6.50	2.93	
3,000	56.60	8.10	.....	.....	
3,500	57.10	8.60	.....	.....	
3,700	57.30	8.80	.....	2.78	
200	55.90	.....	7.40	2.89	
0	.....	.....	.....	.....	
200	55.00	.....	6.50	.....	
400	55.15	6.65	.....	.....	
600	55.30	6.80	.....	.....	
800	55.47	6.95	.....	.....	
1,000	55.56	7.06	.....	.....	
1,500	56.00	7.50	.....	.....	
2,000	56.40	7.90	.....	.....	
2,500	56.60	8.10	.....	.....	
3,000	57.00	8.50	.....	.....	
2,500	57.00	8.50	.....	.....	
2,000	56.90	8.40	.....	.....	
1,500	56.70	8.20	.....	.....	
1,000	56.50	8.00	.....	.....	
500	56.20	7.70	.....	.....	
200	55.90	.....	7.40	2.88	
6,280	.....	.....	.....	.....	Tensile strength.

Parted two strands at the eye-splice.

No. 9144.

⅜″ COTTON ROPE.

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
50	.....	5.30	.....	
100	.....	6.62	.....	
150	.....	7.26	.....	
200	.....	7.69	.....	
250	.....	8.18	.....	
300	.....	8.51	.....	
350	.....	8.94	.....	
400	.....	9.31	.....	
300	.....	9.16	.....	
200	.....	8.90	.....	
100	.....	8.37	.....	
200	.....	8.69	.....	
300	.....	9.03	.....	
400	.....	9.39	.....	
450	.....	9.60	.....	
500	.....	9.87	.....	
550	.....	10.24	.....	
600	.....	10.50	.....	
700	.....	10.91	.....	
800	.....	11.44	.....	
828	.....	.....	.....	Tensile strength.

Parted two strands at the eye-splice.

No. 9145.

⅜″ COTTON ROPE.

Gauged length of 50″ established on rope when dry.
Rope wetted 2 hours.
Tested wet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
50	.....	5.70	.....	
100	.....	8.30	.....	
150	.....	9.91	.....	
200	.....	10.90	.....	
250	.....	11.77	.....	
300	.....	12.50	.....	
350	.....	13.12	.....	
400	.....	13.72	.....	
300	.....	13.59	.....	
200	.....	13.19	.....	
100	.....	12.36	.....	
200	.....	12.79	.....	
300	.....	13.36	.....	
400	.....	13.91	.....	
500	.....	14.62	.....	
600	.....	15.25	.....	
700	.....	15.90	.....	
800	.....	16.47	.....	
900	.....	16.98	.....	
996	.....	.....	.....	Tensile strength.

Parted two strands at the eye splice.

No. 9146.

$\frac{7}{16}$″ COTTON ROPE.

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
50	.....	5.15	.....	
100	.....	6.62	.....	
150	.....	7.32	.....	
200	.....	7.91	.....	
250	.....	8.47	.....	
300	.....	8.86	.....	
350	.....	9.32	.....	
400	.....	9.78	.....	
450	.....	10.14	.....	
500	.....	10.55	.....	
400	.....	10.45	.....	
300	.....	10.32	.....	Rested 15 minutes.
200	.....	10.04	.....	
100	.....	9.61	.....	
200	.....	9.82	.....	
300	.....	10.12	.....	
400	.....	10.34	.....	
500	.....	10.62	.....	
600	.....	11.04	.....	
700	.....	11.53	.....	
800	.....	12.47	.....	
900	.....	.....	.....	Tensile strength.

Parted three strands at the eye splice.

No. 9147.

½″ COTTON ROPE.

Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
50	.....	4.07	.....	
100	.....	5.30	.....	
150	.....	6.13	.....	
200	.....	6.70	.....	
250	.....	7.10	.....	
300	.....	7.50	.....	
400	.....	8.19	.....	
500	.....	8.80	.....	
600	.....	9.29	.....	
700	.....	9.80	.....	
800	.....	10.30	.....	
700	.....	10.28	.....	
600	.....	10.20	.....	
500	.....	10.12	.....	
400	.....	9.97	.....	
300	.....	9.78	.....	
200	.....	9.50	.....	
100	.....	8.94	.....	
200	.....	9.10	.....	
300	.....	9.36	.....	
400	.....	9.60	.....	
500	.....	9.80	.....	
600	.....	10.00	.....	
700	.....	10.24	.....	
800	.....	10.46	.....	
900	.....	10.73	.....	
1,000	.....	11.17	.....	
1,100	.....	11.52	.....	
1,200	.....	11.92	.....	
1,300	.....	12.22	.....	
1,400	.....	12.70	.....	
1,495	.....	.....	.....	Tensile strength.

Parted two strands at the eye splice.

No. 9148.

¾″ Cotton Rope.

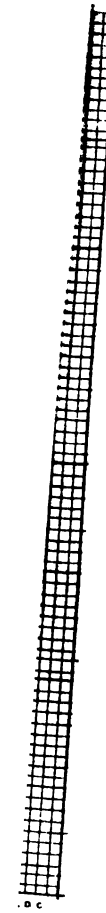
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
50	.....	3.15	.....	
100	.....	4.21	.....	
150	.....	4.99	.....	
200	.....	5.70	.....	
300	.....	6.65	.....	
400	.....	7.51	.....	
500	.....	8.10	.....	
600	.....	8.63	.....	
700	.....	9.18	.....	
800	.....	9.74	.....	
900	.....	10.20	.....	
				Rested 40 minutes.
1,000	.....	10.78	.....	
1,100	.....	11.00	.....	
1,200	.....	11.24	.....	
1,000	.....	11.19	.....	
800	.....	11.10	.....	
600	.....	10.88	.....	
400	.....	10.58	.....	
200	.....	10.10	.....	
100	.....	9.61	.....	
200	.....	9.70	.....	
400	.....	10.10	.....	
600	.....	10.40	.....	
800	.....	10.70	.....	
1,000	.....	11.06	.....	
1,200	.....	11.41	.....	
1,400	.....	11.91	.....	
1,600	.....	12.64	.....	
1,800	.....	13.28	.....	
2,000	.....	13.87	.....	
1,600	.....	13.81	.....	
1,200	.....	13.62	.....	
800	.....	13.30	.....	
400	.....	12.80	.....	
100	.....	11.81	.....	
400	.....	12.20	.....	
800	.....	12.77	.....	
1,200	.....	13.17	.....	
1,600	.....	13.60	.....	
2,000	.....	14.02	.....	
2,200	.....	14.38	.....	
2,400	.....	14.70	.....	
2,580	.....	.....	.....	Tensile strength.

Parted one strand at the eye splice.

CORDAGE.

REPEATED STRESSES.



EXPERIMENTS ON REPEATED STRESSES.

No. 8720.

4″ MANILA ROPE.

From Sewall & Day Mills.
Eye-splices at ends.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
200	.....	2.00	.....	
400	.....	2.40	.....	
600	.....	2.95	.....	
800	.....	3.22	.....	
1,000	.....	3.52	.....	
1,500	.....	4.10	.....	
2,000	.....	4.63	.....	
2,500	.....	4.98	.....	
3,000	.....	5.50	.....	
4,000	.....	6.22	.....	
5,000	.....	6.73	.....	
6,000	.....	7.42	.....	
7,000	.....	7.77	.....	
8,000	.....	8.16	.....	
9,000	.....	8.48	.....	
10,000	.....	8.75	.....	Surface of rope very oily.
5,000	.....	8.51	.....	
10,000	.....	8.95	.....	
5,000	.....	8.67	.....	
10,000	.....	9.00	.....	
5,000	.....	8.73	.....	
10,000	.....	9.04	.....	
5,000	.....	8.74	.....	Loads applied and released between 10,000 and 5,000 pounds 50 times.
5,000	.....	8.90	.....	
10,000	.....	9.12	.....	
5,000	.....	8.90	.....	
1,000	.....	8.44	.....	
5,000	.....	8.74	.....	
10,000	.....	9.14	.....	
5,000	.....	8.87	.....	
10,000	.....	9.14	.....	
10,000	.....	9.31	.....	After sustaining load 1 hour.
9,000	.....	9.23	.....	
8,000	.....	9.20	.....	
7,000	.....	9.18	.....	
6,000	.....	9.10	.....	
5,000	.....	9.03	.....	
4,000	.....	8.98	.....	
3,000	.....	8.91	.....	
2,000	.....	8.73	.....	
1,000	.....	8.62	.....	
2,000	.....	8.63	.....	
3,000	.....	8.70	.....	
4,000	.....	8.82	.....	
5,000	.....	8.88	.....	
6,000	.....	8.95	.....	
7,000	.....	9.00	.....	
8,000	.....	9.10	.....	
9,000	.....	9.18	.....	
10,000	.....	9.22	.....	
11,000	.....	9.36	.....	
12,000	.....	9.40	.....	
13,000	.....	9.60	.....	
14,000	.....	9.67	.....	
15,960	.....	.....	.....	Tensile strength.

Parted one strand at the splice.

No. 8721.

5″ MANILA ROPE.

From Sewall & Day Mills.
Eye splices at ends.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
200	.....	2.45	.....	
400	.....	3.10	.....	
600	.....	3.51	.....	
800	.....	3.90	.....	
1,000	.....	4.13	.....	
1,500	.....	4.67	.....	
2,000	.....	5.07	.....	
2,500	.....	5.38	.....	
3,000	.....	5.62	.....	
5,000	.....	6.61	.....	
6,000	.....	6.93	.....	
7,000	.....	7.21	.....	
8,000	.....	7.53	.....	
9,000	.....	7.90	.....	
10,000	.....	8.11	.....	
11,000	.....	8.38	.....	
12,000	.....	8.60	.....	
13,000	.....	8.80	.....	
14,000	.....	9.03	.....	
15,000	.....	9.23	.....	
16,000	.....	9.40	.....	Surface of rope shows oil.
8,000	.....	9.12	.....	
16,000	.....	9.47	.....	
8,000	.....	9.21	.....	
16,000	.....	9.53	.....	
8,000	.....	9.27	.....	
16,000	.....	9.53	.....	
8,000	.....	9.25	.....	
				Loads applied and released between 16,000 and 8,000 pounds 50 times.
8,000	.....	9.38	.....	
16,000	.....	9.65	.....	
8,000	.....	9.40	.....	
16,000	.....	9.65	.....	
14,000	.....	9.57	.....	
12,000	.....	9.53	.....	
10,000	.....	9.48	.....	
8,000	.....	9.40	.....	
6,000	.....	9.31	.....	
4,000	.....	9.21	.....	
2,000	.....	9.02	.....	
1,000	.....	8.80	.....	
2,000	.....	8.81	.....	
4,000	.....	8.98	.....	
6,000	.....	9.09	.....	
8,000	.....	9.23	.....	
10,000	.....	9.34	.....	
12,000	.....	9.47	.....	
14,000	.....	9.55	.....	
16,000	.....	9.70	.....	
17,000	.....	9.76	.....	
18,000	.....	9.83	.....	
19,000	.....	9.91	.....	
20,000	.....	9.98	.....	
21,000	.....	.....	.....	Tensile strength.

Parted one strand at the splice.

No. 8723.

3½″ SISAL ROPE.

From Sewall & Day Mills.
Eye-splices at ends.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
200	.....	1.34	.....	
400	.....	1.93	.....	
600	.....	2.25	.....	
800	.....	2.61	.....	
1,000	.....	2.84	.....	
1,500	.....	3.38	.....	
2,000	.....	3.82	.....	
2,500	.....	4.20	.....	
3,000	.....	4.58	.....	
3,500	.....	4.98	.....	
4,000	.....	5.36	.....	
4,500	.....	5.70	.....	
5,000	.....	6.09	.....	
5,500	.....	6.52	.....	
3,000	.....	6.40	.....	
5,500	.....	6.72	.....	
3,000	.....	6.45	.....	
5,500	.....	6.82	.....	Oil appears on surface of rope.
3,000	.....	6.58	.....	
5,500	.....	6.91	.....	
3,000	.....	6.60	.....	
				Loads applied and released between 5,500 and 3,000 pounds 50 times.
3,000	.....	6.91	.....	
5,500	.....	7.17	.....	
3,000	.....	6.91	.....	
5,500	.....	7.16	.....	
5,000	.....	7.12	.....	
4,500	.....	7.09	.....	
4,000	.....	7.00	.....	
3,500	.....	6.98	.....	
3,000	.....	6.91	.....	
2,500	.....	6.84	.....	
2,000	.....	6.76	.....	
1,500	.....	6.63	.....	
1,000	.....	6.52	.....	
1,500	.....	6.56	.....	
2,000	.....	6.63	.....	
2,500	.....	6.69	.....	
3,000	.....	6.73	.....	
3,500	.....	6.82	.....	
4,000	.....	6.90	.....	
4,500	.....	6.98	.....	
5,000	.....	7.05	.....	
5,500	.....	7.16	.....	
6,000	.....	7.24	.....	
6,500	.....	7.37	.....	
7,000	.....	7.50	.....	
7,500	.....	7.75	.....	
8,000	.....	8.02	.....	
8,500	.....	8.32	.....	
9,000	.....	8.61	.....	
9,500	.....	8.92	.....	
9,940	.....	.....	.....	Tensile strength.

Parted two strands at the splice.

No. 8724.

3″ MANILA ROPE.

Boston Navy-Yard manufacture.
Eye splices at ends.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
200	.....	1.47	.....	
400	.....	2.18	.....	
600	.....	2.71	.....	
800	.....	3.20	.....	
1,000	.....	3.67	.....	
1,500	.....	4.61	.....	
2,000	.....	5.35	.....	
3,000	.....	6.45	.....	
4,000	.....	7.32	.....	
5,000	.....	8.06	.....	
6,000	.....	8.54	.....	
7,000	.....	8.96	.....	
8,000	.....	9.33	.....	
4,000	.....	9.09	.....	
8,000	.....	9.46	.....	
4,000	.....	9.13	.....	
8,000	.....	9.51	.....	
4,000	.....	9.20	.....	
8,000	.....	9.55	.....	
4,000	.....	9.23	.....	
7,940	.....	.....	.....	Tensile strength.

Loads applied and released between 8,000 and 4,000 pounds 43 times. On the forty-fourth loading the rope parted one strand at the splice under a tensile stress of 7,940 pounds.

CORDAGE.

STRAINED IN THE TESTING MACHINE AND THEN WETTED.

CORDAGE.

Observations on the behavior of manila and sisal rope wet under stress.

Samples have eye splices in ends for securing to testing machine.

No. 9128.

3¾″ MANILA.

From Sewall & Day Mills.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
100	.....	1.51	.....	
200	.....	2.01	.....	
300	.....	2.39	.....	
400	.....	2.57	.....	
500	.....	2.71	.....	
600	.....	2.90	.....	
800	.....	3.18	.....	
1,000	.....	3.44	.....	
1,500	.....	3.99	.....	
2,000	.....	4.27	.....	
2,000	.....	4.39	.....	After sustaining load 5 minutes.
2,000	.....	4.41	.....	After sustaining load 10 minutes.
2,000	.....	4.43	.....	After sustaining load 15 minutes.
				Began to wet the rope, using water at about 90° F., applied with sponges.
2,000	.....	4.50	.....	After 10 minutes' wetting.
2,000	.....	4.59	.....	After 20 minutes' wetting.
2,000	.....	4.65	.....	After 30 minutes' wetting.
				Stopped applying water; rope remained damp in wrapping of other wet rope.
2,000	.....	4.71	.....	Wetting resumed 2 hours later.
2,000	.....	4.70+	.....	After 25 minutes' wetting.
2,000	.....	4.75	.....	After 1 hour's wetting.
2,000	.....	4.74	.....	After 1¼ hour's wetting.
				Wetting discontinued.
1,500	.....	4.68	.....	
2,000	.....	4.73	.....	
1,500	.....	4.69	.....	
1,000	.....	4.62	.....	
1,500	.....	4.68	.....	
2,000	.....	4.73	.....	
500	.....	4.50	.....	
100	.....	4.27	.....	
100	.....	4.19	.....	After 2 minutes.
1,000	.....	4.40	.....	
2,000	.....	4.69	.....	
2,000	.....	4.73	.....	After 5 minutes.
100	.....	4.20	.....	
100	.....	4.15	.....	After 5 minutes.
				Wetting resumed.
100	.....	4.04	.....	After wetting 20 minutes.
100	.....	4.00	.....	After wetting 35 minutes.
				Wetting discontinued.
2,000	.....	4.61	.....	
2,000	.....	4.68	.....	After 5 minutes.
15,100	.....	.....	.....	Tensile strength.

Parted one strand at middle of length.

No. 9129.

3″ MANILA.

From Sewall & Day Mills.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
100	.....	1.41	.....	
200	.....	1.85	.....	
300	.....	2.08	.....	
400	.....	2.25	.....	
500	.....	2.44	.....	
600	.....	2.61	.....	
800	.....	2.93	.....	
1,000	.....	3.18	.....	
1,500	.....	3.70	.....	
2,000	.....	4.20	.....	
2,000	.....	4.45	.....	After 15 minutes.
2,000	.....	.....	.....	Load left on rope at end of the day.
1,500	.....	4.46	.....	Load on the rope the following morning, 16 hours later.
1,500	.....	.....	.....	Began wetting the rope.
1,500	.....	4.46	.....	After wetting 10 minutes.
1,500	.....	4.46	.....	After wetting 30 minutes.
				Slight falling off in the load after 40 minutes wetting.
1,500	.....	4.46+	.....	After wetting 1 hour.
1,500	.....	4.46+	.....	After wetting 1½ hours.
1,500	.....	4.47	.....	After wetting 2 hours.
1,500	.....	4.48	.....	After wetting 2½ hours.
1,500	.....	4.49	.....	After wetting 3 hours.
				Wetting discontinued.
2,000	.....	4.56	.....	
3,000	.....	4.89	.....	
4,000	.....	5.52	.....	
5,000	.....	6.17	.....	
6,000	.....	6.73	.....	
7,000	.....	7.12	.....	
8,000	.....	7.50	.....	
9,000	.....	7.77	.....	
9,620	.....	.....	.....	Tensile strength.

Parted one strand at the eye-splice.

No. 9130.

3″ MANILA.

From Boston Navy-Yard.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
100	.....	1.20	.....	
200	.....	1.81	.....	
300	.....	2.20	.....	
400	.....	2.55	.....	
500	.....	2.80	.....	
500	.....	2.84	.....	After 2 minutes.
500	.....	3.00	.....	After 30 minutes.
500	.....	3.01	.....	After 35 minutes.
500	.....	3.01	.....	After 40 minutes.
500	.....	3.01	.....	After 50 minutes.
				Began wetting the rope.
500	.....	3.04	.....	After wetting 10 minutes.
500	.....	3.07	.....	After wetting 20 minutes.
500	.....	3.10	.....	After wetting 30 minutes.
500	.....	3.10	.....	After wetting 40 minutes.
500	.....	3.10	.....	After wetting 50 minutes.
500	.....	3.10	.....	After wetting 1 hour.
500	.....	3.11	.....	After wetting 1 hour 10 minutes.
500	.....	3.12	.....	After wetting 1 hour 20 minutes.
500	.....	3.16	.....	After wetting 2 hours.
500	.....	3.15	.....	After wetting 2½ hours.
500	.....	3.18	.....	After wetting 3 hours.
500	.....	3.19	.....	After wetting 3½ hours.
				Wetting discontinued. Rope remained in the testing machine over night.
330	.....	3.22	.....	Load and elongation after 16 hours.
500	.....	3.30	.....	
				Wetting resumed.
500	.....	3.32	.....	After wetting 5 minutes.
500	.....	3.32	.....	After wetting 10 minutes.
500	.....	3.32	.....	After wetting 20 minutes.
500	.....	3.32	.....	After wetting 35 minutes.
500	.....	3.31	.....	After wetting 1 hour 10 minutes.
500	.....	3.32	.....	After wetting 1 hour 40 minutes.
				Wetting discontinued.
800	.....	3.49	.....	
1,000	.....	3.72	.....	
1,500	.....	4.49	.....	
2,000	.....	5.29	.....	
2,500	.....	5.92	.....	
3,000	.....	6.46	.....	
4,000	.....	7.26	.....	
5,000	.....	7.91	.....	
6,000	.....	8.37	.....	
7,000	.....	8.70	.....	
8,000	.....	9.00	.....	
9,000	.....	9.19	.....	
10,000	.....	9.39	.....	
10,900	.....	.....	.....	Tensile strength.

Parted one strand 10″ from the eye-splice.

No. 9131.

3″ SISAL.

From Sewall & Day Mills.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
100	.....	1.03	.....	
100	.....	1.04	.....	After 10 minutes.
100	.....	1.06	.....	After 20 minutes.
100	.....	1.08	.....	After 30 minutes.
				Began to wet the rope.
100	.....	1.00	.....	After wetting 10 minutes.
100	.....	.97	.....	After wetting 20 minutes.
100	.....	.95	.....	After wetting 40 minutes.
100	.....	.94	.....	After wetting 55 minutes.
				Wetting discontinued for 1 hour.
100	.....	.94	.....	Elongation at end of hour.
				Wetting resumed.
100	.....	.93	.....	After wetting 30 minutes.
				Rope removed from the testing machine. When released from the pins through the eyes the rope increased its twist one-quarter of a turn in a length of 6 feet.
				It now measures 50″.07 on the gauged length when the quarter turn was taken out for the purpose of bringing the gauge marks on the same side of the rope.
				After resting 15 minutes without load the gauged length measured 49″.76, the rope having made about one-quarter turn in 6 feet.
				The quarter turn was taken out and rope returned to the testing machine.
100	.....	.07	.....	
100	.....	.11	.....	After 3 minutes.
100	.....	.13	.....	After 8 minutes.
				Wetting resumed.
100	.....	.19	.....	After wetting 5 minutes.
100	.....	.19	.....	After wetting 10 minutes.
100	.....	.19	.....	After wetting 20 minutes.
				Wetting discontinued.
200	.....	.48	.....	
200	.....	.62	.....	After 5 minutes.
300	.....	.91	.....	
400	.....	1.38	.....	
500	.....	1.69	.....	
600	.....	2.22	.....	After sustaining load 3 minutes.
800	.....	2.49	.....	
1,000	.....	2.96	.....	
1,500	.....	3.75	.....	
2,000	.....	4.58	.....	
3,000	.....	5.90	.....	
4,000	.....	6.97	.....	
5,000	.....	7.85	.....	
6,000	.....	8.48	.....	
6,210	.....	.....	.....	Tensile strength.

Parted one strand at the splice.

CORDAGE.

TESTS OF KNOTS AND HITCHES.

CORDAGE.

TENSILE TESTS OF SPLICES, KNOTS, AND HITCHES IN MANILA AND SISAL ROPE.

No. of test.	Description.	Tensile strength.	Parted.
		Pounds.	
9120	9-thread sisal. Making a rolling hitch on 5" manila rope.	534	The sisal line at the hitch.
9121	1¼" sisal. Making a rolling hitch on 5" manila rope.	1,175	One strand of sisal rope at the hitch.
9122	1¼" sisal. Making a rolling hitch on 5" manila rope.	1,664	Do.
9123	2¼" manila, 4 strands. Making a rolling hitch on 5" manila rope.	3,840	One strand of 2¼" rope at the hitch.
9124	2¼" manila, 4 strands. One end provided with an eye-splice, the other end with a "cat's-paw."	3,320	One strand at the "cat's-paw."
9118	3¼" manila, 3 strands. Two pieces of rope joined together with eye-splices. The ends were secured to pins in the testing machine by means of eye-splices.	12,080	One strand at an eye-splice securing specimen to the testing machine.
9119	3¼" manila, 3 strands. Two pieces of rope joined together with short splice. Ends secured to pins in the testing machine by means of eye-splices.	10,430	One strand at the short splice.
9114	3¾" manila, 3 strands. Two pieces of rope joined together with shroud knot. Ends secured by pins through eye-splices.	9,120	One strand at the shroud knot.
9125	4" manila, 4 strands. Two pieces of rope joined together with short splice. Ends secured by pins through eye-splices.	11,420	One strand at eye-splice in end.
9127	4" manila, 3 strands. Two pieces of rope joined together with short splice. Ends secured by pins through eye-splices.	14,800	One strand at the short splice.
9115	5" manila, 3 strands. Two pieces of rope joined together with single Garrick bend, with ends stopped back with two sets of racking seizings. Ends of ropes secured by pins through eye-splices.	5,200	The hitch drew together and pulled the end from under the seizings, unrolling without parting the rope.
9115a	Hitch remade and new seizings put on.....	11,700	One strand at the hitch.
9116	6" manila, 3 strands. Two pieces of rope joined together with single Garrick bend. Ends secured by pins through eye-splices.	17,100	Do.
9117	8" manila, 3 strands. One end secured to pin with an eye-splice, the other end secured to pin by means of an anchor knot.	50,300	One strand of the standing part, where the end of the rope took the first turn over the standing part, back of the half-hitch, in the anchor knot.
9126	8¼" manila, 3 strands. Two pieces of rope joined together with short splice. Ends secured by pins through eye-splices.	47,400	One strand at the short splice.

Material from Sewall and Day Mills, Boston, Mass.

Specimens with eye-splices in the ends and having a single knot at the middle of length.

No. of test.	Description.	Tensile strength.	Parted.
		Pounds.	
8917	2″ 3-strand sisal. Tested dry	1,740	One strand at the knot.
8918	2″ 3-strand sisal. Tested with the knot wet	2,020	Do.
8915	2″ 3-strand manila. Tested dry	2,310	Do.
8916	2″ 3-strand manila. Tested with knot wet	3,120	Do.
8913	2¼″ 3-strand manila. Tested dry	2,980	Do.
8914	2¼″ 3-strand manila. Tested with knot wet	4,310	Do.
8919	4½″ 3-strand manila. Tested dry	9,950	Do.
8920	4½″ 3-strand manila. Tested with knot wet	12,900	Do.

CORDAGE.

UNDER CONTINUOUS LOADS, WET AND DRY CONDITIONS.

CORDAGE.

4″ MANILA ROPE.

Four strands from Boston Navy-Yard.
Shot weighing 460 pounds suspended by rope in vertical position.
Gauged length, 30″.

Time of observation.	Elapsed time.	Gauged length.	Elongation.	Remarks.
H. M. 1897.	*Days. Hrs.*	*Inches.*	*Inches.*	
May 12				
9 00	.....	.....	.....	No load.
9 00	.....	.....	.....	Loaded with 460 pounds.
9 15	0 ¼	31.85	1.85	Raining; rope protected by canvas roof and wrapping of cotton cloth.
9 50	0 ¾	31.85	1.85	Rope uncovered and rain allowed to fall upon it.
11 00	0 2	31.89	1.89	
11 35	0 2½	31.84	1.84	
11 45	0 2¾	.....	.....	Stopped raining.
1 00	0 4	31.89	1.89	
4 45	0 7¾	31.90	1.90	
May 13				
8 00	0 23	31.95	1.95	Raining; began to rain during previous night.
4 40	1 7¾	32.00	2.00	Showery during the day.
May 14				
8 10	2 23¼	32.03	2.03	Clear weather; heavy showers during previous night.
1 40	2 4¾	32.17	2.17	Clear weather since morning; now sprinkles.
5 00	2 8	32.18	2.18	Clear weather.
May 15				
8 00	2 23	32.18	2.18	Clear weather over night.
4 30	3 7½	32.40	2.40	Clear, sunny day.
May 17				
8 00	4 23	32.49	2.49	Clear weather since last observation.
May 18				
4 50	6 7¾	32.68	2.68	Do.
May 19				
4 30	7 7½	32.81	2.81	Do.
May 20				
4 30	8 7½	32.84	2.84	Do.
May 21				
4 00	9 7	32.88	2.88	Do.
May 22				
8 10	9 23¼	32.84	2.84	Clear weather; showery during preceding night.
4 50	10 7¾	32.88	2.88	
May 24				
8 30	11 23½	.....	.....	Cloudy.
9 30	12 ¼	32.86	2.86	Rain begins.
1 15	12 4¼	32.86	2.86	Cloudy; occasional light showers.
May 25				
8 10	12 23¼	32.81	2.81	Cloudy; heavy rain during preceding night.
4 50	13 7¾	32.80	2.80	Clear weather past 5 hours.
May 27				
4 45	15 7¾	32.80	2.80	Raining in morning; cleared in afternoon.
June 5				
2 30	24 5½	32.84	2.84	Cloudy; rained during preceding night.
June 10				
10 30	29 1½	32.77	2.77	Has been raining 36 hours.
Aug. 27				
9 30	107 ½	33.71	3.71	Clear weather.

⅝″ Cotton Rope.

Seventy pounds weight suspended by rope.
Gauged length, 30″.

Time of observation.	Elapsed time.	Gauged length.	Elongation.	Remarks.
H. M. 1897.	*Days. Hrs.*	*Inches.*	*Inches.*	
May 12				
11 17	.....	30.00	.....	Loaded with 70 pounds weight. Raining; rope protected by canvas covering from the rain.
11 36	¼	33.50	3.50	Raining.
11 45	½	.....	.....	Stopped raining; rope uncovered.
1 00	1¼	33.62	3.62	
4 45	5½	33.73	3.73	
May 13	.....	.....	.....	Began to rain during the night.
8 00	20¾	33.84	3.84	Raining.
4 40	1 5½	34.05	4.05	Showery during the day.
May 14				
8 10	1 21	34.06	4.06	Clear; heavy showers during preceding night.
1 40	2 2½	34.50	4.50	Clear weather since morning; now sprinkles.
5 00	2 5¾	34.49	4.49	Clear weather.
May 15				
8 00	2 20¾	34.49	4.49	Clear weather overnight.
4 30	3 5¼	35.16	5.16	Clear, sunny day.
May 17				
8 00	4 20¾	35.08	5.08	Clear weather since last observation.
May 18				
4 50	6 5½	35.45	5.45	Do.
May 19				
4 30	7 5¼	35.57	5.57	Do.
May 20				
4 30	8 5¼	35.49	5.49	Do.
May 21				
4 00	9 4¾	35.26	5.26	Do.
May 22				
8 10	9 21	35.22	5.22	Showery during preceding night; clear at present.
4 50	10 5½	35.50	5.50	Clear weather.
May 24				
8 30	11 21¾	.....	.....	Cloudy, but no rain.
9 30	11 22¾	35.18	5.18	Rain begins.
1 15	12 2	35.13	5.13	Cloudy; occasional light showers.
May 25				
8 10	12 21	34.80	4.80	Cloudy; heavy rain during preceding night.
4 50	13 5½	34.93	4.93	Clear weather past 5 hours.
May 27				
4 45	15 5½	35.07	5.07	Rained in the morning; cleared in the afternoon.
June 5				
2 30	24 3¼	34.91	4.91	Cloudy; rained the night previous.
June 10				
10 30	28 23¾	34.78	4.78	Has been raining 36 hours.
Aug. 27				
9 30	106 22¾	36.08	6.08	Clear weather.

No. 9.—Linen Shot Line.

Sample from coil No. 4218.
Tensile strength, 1,195 pounds..
Thirty-three pounds weight suspended by the rope.
Gauged length, 30″.

Time of observation.	Elapsed time.		Gauged length.	Elongation.	Remarks.
H. M. 1897.	*Days.*	*Hrs.*	*Inches.*	*Inches.*	
May 12					
11 35	.....		30.00	.....	Loaded with 33 pounds weight. Raining.
11 40	.....		32.25	2.25	Rope now covered with canvas to protect from rain.
11 45		¼	.....	.....	Stopped raining.
1 00		1⅛	32.38	2.38	Rope uncovered.
4 45		5½	32.44	2.44	Present lay of rope, 1 turn in 1″.42.
May 13					
8 00		20⅛	32.53	2.53	Raining. Began to rain during previous night.
4 40	1	5	32.84	2.84	Showers during the day.
May 14					
8 10	1	20⅛	32.68	2.68	Clear weather; heavy showers during the night.
1 40	2	2	33.26	3.26	Clear since morning; now sprinkles.
5 00	2	5⅛	33.27	3.27	Clear weather.
May 15					
8 00	2	20⅛	33.27	3.27	Clear weather overnight.
4 30	3	5	33.56	3.56	Clear, sunny day.
May 17					
8 00	4	20⅛	33.48	3.48	Clear weather since last observation.
May 18					
4 50	6	5½	33.60	3.60	Do.
May 19					
4 30	7	5	33.62	3.62	Do.
May 20					
4 30	8	5	33.62	3.62	Do.
May 21					
4 00	9	4⅛	33.50	3.50	Do.
May 22					
8 10	9	20⅛	33.47	3.47	Clear weather; showery during preceding night.
4 50	10	5½	33.64	3.64	Clear weather.
May 24					
8 30	11	21	.....	.....	Cloudy, but no rain.
9 20	11	21⅝	33.39	3.39	Rain begins.
1 15	12	1⅝	33.40	3.40	Cloudy; occasional light showers.
May 25					
8 10	12	20⅛	32.76	2.76	Cloudy; heavy rain preceding night.
4 50	13	5½	33.32	3.32	Clear weather past 5 hours.
May 27					
4 45	15	5½	33.49	3.49	Rained in morning; cleared in afternoon.
June 5					
2 30	24	3	33.09	3.09	Cloudy; rained the previous night.
June 10					
10 30	28	23	32.84	2.84	Has been raining 36 hours.
Aug. 27					
9 30	106	22	33.73	3.73	Clear weather. Lay of rope at present time, 1 turn in 1″.85.

1¾″ MANILA ROPE.

From Sewall & Day Mills.
Ten pounds weight suspended by rope.
Gauged length, 30″.

Time of observation.	Elapsed time.	Gauged length.	Elongation.	Remarks.
H. M. 1897.	*Days. Hrs.*	*Inches.*	*Inches.*	
May 22				
3 00	.....	30.00	.....	Rope now loaded with 10 pounds weight in testing room.
May 24				
8 30	1 17½	30.75	.75	
9 00	1 18	.....	.....	Put out of doors. Showery weather.
1 15	1 22½	30.66	.66	Cloudy weather, with occasional light showers.
May 25				
8 10	2 17½	30.60	.60	Cloudy; heavy rain during preceding night.
4 50	3 1½	30.60	.60	Clear weather for the past 5 hours.
May 26				
11 00	3 20	30.64	.64	Light rain.
May 27				
4 45	5 1½	30.58	.58	Rained in forenoon; cleared in afternoon.
June 5				
2 30	13 23½	30.91	.91	Cloudy; rained the night previous.
June 10				
10 30	18 19½	30.60	.60	Has been raining 36 hours.
June 26				
3 45	35 ½	32.04	2.04	Weight suspended by rope increased from 10 to 80 pounds.
4 00	35 1	32.34	2.34	Immediate length after increase of weight
4 30	35 1½	32.41	2.41	
4 55	35 2	32.42	2.42	
June 27				
8 50	35 17½	32.58	2.58	
Aug. 27				
9 30	96 18½	33.54	3.54	Clear weather.
Oct. 12				
4 30	143 1½	33.71	3.71	Rainy afternoon.
Oct. 13				
8 45	143 17½	33.54	3.54	Clear weather.
1 05	143 22	33.58	3.58	Do.

Test discontinued.

1¾″ MANILA ROPE.

From Sewall & Day Mills.
Sixty pounds suspended by rope.
Gauged length, 30″.

Time of observation.	Elapsed time.		Gauged length.	Elongation.	Remarks.
H. M.	*Days.*	*Hrs.*	*Inches.*	*Inches.*	
May 22					
3 00	.....		30.00	.....	Rope loaded with 60 pounds weight in testing room.
May 24					
8 30	1	17½	31.42	1.42	
9 00	1	18	.....	.....	Rope put out of doors. Showery weather.
1 15	1	22¼	31.40	1.40	Cloudy weather, with occasional light showers.
May 25					
8 10	2	17½	31.37	1.37	Cloudy; heavy rain during preceding night.
4 50	3	1½	31.49	1.49	Clear weather for the past 5 hours.
May 26					
11 00	3	20	31.54	1.54	Light rain.
May 27					
4 45	5	1¾	31.53	1.53	Rained in forenoon; cleared in afternoon.
June 5					
2 30	13	23½	31.93	1.93	Cloudy; rained the night previous.
June 10					
10 30	18	19½	31.72	1.72	Has been raining 36 hours.
Aug. 27					
9 30	96	18½	33.61	3.61	Clear weather.
Oct. 12					
4 30	143	1½	33.60	3.60	Rainy afternoon.
Oct. 13					
8 45	143	17¾	33.31	3.31	Clear weather.
1 05	143	22	33.46	3.46	Do.

Test discontinued.

$3\frac{3}{4}''$ MANILA ROPE.

From Sewall & Day mills.
Four hundred and sixty pounds suspended by rope.
Guaged length, 30″.

Time of observation.	Elapsed time.	Gauged length.	Elongation.	Remarks.
H. M.	*Hours.*	*Inches.*	*Inches.*	
Aug. 27				
10 25	.....	32.59	2.59	Immediate elongation. Dry rope.
10 35	.....	32.65	2.65	Dry rope.
10 45	$\frac{1}{4}$	32.70	2.70	Do.
10 55	$\frac{1}{2}$	32.70	2.70	Do.
11 05	.....	32.69	2.69	Do.
11 15	$\frac{3}{4}$	32.68	2.68	Do.
11 25	1	32.68+	2.68+	Do.
11 35	.....	32.69	2.69	Do.
11 45	$1\frac{1}{4}$	32.68	2.68+	Do.
11 55	$1\frac{1}{2}$	32.69	2.69	Do.
1 00	$2\frac{1}{2}$	32.73	2.73	Do.
				Began wetting the rope with hose pipe.
1 10	$2\frac{1}{2}$	32.72	2.72	Wet rope.
1 20	3	32.73	2.73	Do.
1 30	.....	32.75	2.75	Do.
1 40	$3\frac{1}{2}$	32.73	2.73	Do.
1 50	.....	32.72+	2.72+	Do.
2 00	$3\frac{1}{2}$	32.74	2.74	Do.
2 10	$3\frac{1}{2}$	32.75+	2.75+	Do.
2 20	.....	32.76	2.76	Do.
2 30	4	32.75	2.75	Do.
2 40	$4\frac{1}{2}$	32.75+	2.75+	Do.
2 50	.....	32.76	2.76	Do.
3 00	$4\frac{1}{2}$	32.75	2.75	Do.
3 10	$4\frac{1}{2}$	32.74+	2.74	Do.
3 20	.....	32.76	2.76	Do.
3 30	5	32.77	2.77	Do.
3 40	$5\frac{1}{2}$	32.79	2.79	Do.
3 50	.....	32.79	2.79	Do.
4 00	$5\frac{1}{2}$	32.80	2.80	Do.
4 10	$5\frac{1}{2}$	32.80	2.80	Do.
4 20	.....	32.80	2.80	Do.
4 30	6	32.80	2.80	Water shut off.
4 40	$6\frac{1}{2}$	32.80	2.80	Do.
4 50	$6\frac{1}{2}$	32.80	2.80	Do.
Aug. 28				
8 25	22	32.99	2.99	Do.

Test discontinued.

2″ MANILA ROPE.

From Sewall & Day Mills.
Four hundred and sixty pounds suspended by rope.
Gauged length, 30″.

Time of observation.	Elapsed time.	Gauged length.	Elongation.	Remarks.
H. M.	*Days. Hrs.*	*Inches.*	*Inches.*	
Aug. 28				
1 10	.....	33.17	3.17	Immediate elongation. Dry rope.
1 20	.....	33.33	3.33	Dry rope.
1 30	¼	33.33	3.33	Do.
1 40	½	33.34	3.34	Do.
1 50	.....	33.35	3.35	Do.
2 00	¾	33.37	3.37	Do.
2 10	1	33.40	3.40	Do.
2 20	.....	33.40	3.40	Began wetting the rope with hose pipe.
2 30	1¼	33.42	3.42	Rope wet.
2 40	1½	33.44	3.44	Do.
2 50	.....	33.44	3.44	Do.
3 00	1¾	33.46	3.46	Do.
3 10	2	33.48	3.48	Do.
3 20	.....	33.50	3.50	Do.
3 30	2¼	33.50	3.50	Do.
3 40	2½	33.51	3.51	Do.
3 50	.....	33.52+	3.52+	Do.
4 00	2¾	33.55	3.55	Do.
4 10	3	33.58	3.58	Do.
4 20	.....	33.62	3.62	Do.
4 30	3	33.62	3.62	Do.
4 40	3¼	33.63	3.63	Do.
4 50	3½	33.63	3.63	Do.
Aug. 30				
8 20	1 19	34.48	4.48	Rope dry.
9 30	1 20½	34.48	4.48	Do.

Test discontinued.

3″ MANILA ROPE.

From Sewall & Day mills.
Four hundred and sixty pounds suspended by rope.
Gauged length, 30″.

Time of observation.	Elapsed time.	Gauged length.	Elongation.	Remarks.
H. M.	*Days. Hrs.*	*Inches.*	*Inches.*	
Aug. 30				
9 40	.....	32.04	2.04	Immediate elongation.
9 50	.....	32.13	2.13	Rope dry.
10 00	.....	32.15	2.15	Do.
10 10	¼	32.16	2.16	Do.
10 20	.....	32.16+	2.16+	Do.
10 30	½	32.16	2.16	Do.
10 40	1	32.16+	2.16+	Do.
				Began wetting the rope with hose pipe.
10 50	.....	32.20	2.20	Rope wet.
11 00	1¼	32.22	2.22	Do.
11 10	1½	32.23+	2.23+	Do.
11 20	.....	32.24	2.24	Do.
11 30	1¾	32.24	2.24	Do.
11 40	2	32.24+	2.24+	Do.
11 50	2¼	32.26	2.26	Do.
1 00	3½	32.34	2.34	Do.
1 10	3¾	32.34	2.34	Do.
				Load removed 10 minutes.
1 20	.....	32.20	2.20	Rope wet. Weight reapplied before measuring.
1 30	3¾	32.32	2.32	Rope wet.
				Load removed 20 minutes, then reapplied before measuring.
1 50	.....	32.16	2.16	Stopped wetting the rope.
2 00	4¼	32.25	2.25	
2 10	4½	32.28	2.28	
2 20	4¾	32.31	2.31	
2 40	5	32.33	2.33	
3 00	5¼	32.34	2.34	
3 10	5½	32.35	2.35	
3 20	.....	32.35+	2.35+	
3 50	5¾	32.36+	2.36+	
4 40	7	32.40	2.40	
4 50	7¼	32.42	2.42	
Aug. 31				
8 45	23	32.55	2.55	
				Began wetting the rope.
11 50	1 2¼	32.51	2.51	Rope wet.
4 40	1 7	32.55	2.55	Do.
				Stopped wetting the rope. No water on rope over night, about 16 hours.
Sept. 1				
8 25	1 22¾	32.65	2.65	
				Commenced wetting the rope.
4 55	2 7¼	32.61	2.61	Rope wet all day.
Sept. 2				
8 40	2 23	32.61	2.61	Has been raining about 3 hours.
1 05	3 3¼	32.60+	2.60+	Raining; cleared about 3 o'clock.
4 15	3 7	32.63	2.63	Clear weather.
Sept. 3				
8 15	3 22¼	32.68	2.68	Do.
Sept. 8				
9 00	8 23½	33.93	3.93	Cloudy.
Sept. 11				
1 05	12 3¼	34.15	4.15	Has been raining about 20 minutes.
4 50	12 7¼	34.14+	4.14+	
Oct. 12				
4 30	43 6¾	34.25	4.25	Rainy afternoon.
Oct. 13				
8 45	43 23	34.13	4.13	Clear weather.
1 05	44 3¼	34.13	4.13	Do.

Test discontinued.

CORDAGE.

FREE CONTRACTION OF WET ROPES IN TANK AND OUT OF DOORS.

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CORDAGE.

1⅝″ MANILA ROPE.

From Sewall and Day Mills.

Gauged length of 30″ established on a new piece of rope; then the sample was exposed to the action of the rain out of doors, the sample not being loaded in the meantime, free contraction permitted.

Time of observation.	Elapsed time.	Gauged length.	Contraction.	Remarks.
H. M.	*Days. Hrs.*	*Inches.*	*Inches.*	
Sept. 10				
10 50	0 0	30.00	.....	Exposed to rain.
12 50	0 2	30.00+	.....	Rain continues.
4 45	0 6	29.87	0.13	Raining since last observation. The twist in the rope increased during this period of wetting.
Sept. 11				
8 30	0 21¾	29.68	0.32	Weather cleared during the preceding night, but rope still wet.
9 00	0 22¼	.....	.....	Rope immersed in tank of cold water.
Sept. 12				
10 30	1 23¾	28.65	1.35	Rope still kept in water.
Sept. 14				
10 30	3 23¾	28.42	1.58	Continued in water.
Sept. 19				
4 00	9 5¼	28.32	1.68	Do.
Sept. 21				
8 30	10 21¾	28.22	1.78	Do.
Sept. 28				
9 10	17 22¼	28.18	1.82	Do. Rope taken from tank of water and measured.
Dec. 14				
10 30	94 23¾	28.03	1.97	

6¼″ MANILA ROPE.

From Sewall and Day Mills.

Sample about 12 feet long.

Gauged length of 100″ laid off, then sample immersed in cold water.

Ti observation.	Elapsed time.	Gauged length.	Contraction.	Remarks.
H. M.	*Days. Hrs.*	*Inches.*	*Inches.*	
Feb. 6				
9 [illegible]	0 0	100.00	0.	Immersed in water.
9 4	0 ¼	98.95	1.05	
10 05	0 ¾	98.48	1.52	
11 00	0 1¾	98.03	1.97	
11 55	0 2¾	97.80	2.20	
3 00	0 5¼	96.96	3.04	
Feb. 27				
8 25	20 23	95.92	4.08	
Mar. 1				
8 15	22 22¾	95.54	4.46	Twist of rope increased one full turn in the gauged length.
Mar. 2				
9 00	23 23⅛	95.22	4.78	Actual circumference at present time, 7″.67.
Mar. 6				
10 30	28 1	94.87	5.13	
Mar. 17				
8 00	38 22⅛	94.57	5.43	Weight, wet, 26½ pounds. Length over all, wet, approximate, 146½″. Lay, one turn in 5″.3, wet. Rope laid out on floor of machine shop to dry.
Apr. 8	.....	95.30	4.70	Again measured after drying. Weight, dry, 17½ pounds. Length over all, dry, approximate, 148″. Lay, one turn in 5″.4, dry.

9″ MANILA ROPE.

From Sewall & Day Mills.
Sample about 12 feet long.
Gauged length of 100″ laid off, then sample immersed in cold water.

Time of observation.	Elapsed time.		Gauged length.	Contraction.	Remarks.
H. M.	*Days.*	*Hrs.*	*Inches.*	*Inches.*	
Feb. 6					
9 25	0	0	100.00	0.	Immersed in water.
9 40	0	¼	98.04	1.96	
10 05	0	¾	97.50	2.50	
11 00	0	1½	97.13	2.87	
11 55	0	2½	96.68	3.32	
3 00	0	5½	95.82	4.18	
Feb. 27					
8 25	20	23	95.20	4.80	
Mar. 1					
8 15	22	22¾	94.65	5.35	
Mar. 2					
9 00	23	23½	94.42	5.58	Actual circumference at present time, 10″.96.
Mar. 6					
10 30	28	1	94.10	5.90	
Mar. 17					
8 00	38	22½	93.96	6.04	Weight, wet, 54½ pounds. Length over all, wet, approximate, 148½″. Lay, one turn in 7″.3, wet. Rope laid out on floor of machine shop to dry.
Apr. 8	.....		94.10	5.90	Again measured after drying. Weight, dry, 36½ pounds. Length over all, dry, approximate, 149″. Lay, one turn in 7″.5, dry.

9½″ MANILA ROPE.

From Sewall & Day Mills.
Sample about 12 feet long.
Gauged length of 100″ laid off, then sample immersed in cold water.

Time of observation.	Elapsed time.		Gauged length.	Contraction.	Remarks.
H. M.	*Days.*	*Hrs.*	*Inches.*	*Inches.*	
Feb. 6					
9 25	0	0	100.00	0.	Immersed in water.
9 40	0	¼	99.18	.82	
10 05	0	¾	98.80	1.20	
11 00	0	1½	98.46	1.54	
11 55	0	2½	98.19	1.81	
3 00	0	5½	97.54	2.46	
Feb. 27					
8 25	20	23	96.86	3.14	
Mar. 1					
8 15	22	22¾	96.56	3.44	
Mar. 2					
9 00	23	23½	96.36	3.64	Actual circumference at present time, 10″.96.
Mar. 6					
10 30	28	1	96.10	3.90	
Mar. 17					
8 00	38	22½	95.70	4.30	Weight, wet, 58½ pounds. Length over all, wet, approximate, 155¾″. Lay, one turn in 7″.4, wet. Rope laid out on floor of machine shop to dry.
Apr. 8	.....		96.20	3.80	Again measured after drying. Weight, dry, 41¾ pounds. Length over all, dry, approximate, 156½″. Lay, one turn in 7″.42, dry.

MANILA ROPE FROM SEWALL & DAY MILLS, BOSTON, MASS.

No. of test.	Nominal size of rope.	Actual circumference.	Diameter.	Number of strands.	Threads per strand.	Threads in core.	Lay, one turn in—	Length.		Weight.		Weight per fathom.		Tensile strength.	Parted.
		Inches.	*Inches.*				*Inches.*	*Ft.*	*In.*	*Lbs.*	*Oz.*	*Pounds.*	*Ounces.*	*Pounds.*	
8630	6-thread	0.84	0.27	3	2	.....	0.75	74	7	1	5¾	.....	1.7	756	1 strand 15″ from splice.
	.....do													758	1 strand at the splice.
	.....do													761	2 strands at middle of length.
8631	9-thread	1.00	.30	3	3	.....	.90	89	10	2	7	.....	2.6	1,041	1 strand 24″ from splice.
	.....do													1,108	1 strand 16″ from splice.
	.....do													1,042	1 strand 24″ from splice.
8632	12-thread	1.20	.38	3	4	.....	1.10	91	5	3	4¾	.....	3.5	1,430	1 strand 11″ from splice.
	.....do													1,577	1 strand 24″ from splice.
	.....do													1,412	1 strand at middle of length.
8633	15-thread	1.42	.43	3	5	.....	1.25	93	1	4	6½	.....	4.5	2,305	1 strand at the splice.
	.....do													2,040	Do.
	.....do													2,195	1 strand 18″ from splice.
8634	1¼-inch	1.58	.49	3	6	.....	1.55	102	7	5	11½	.....	5.4	2,290	1 strand 24″ from splice.
	.....do													2,200	1 strand 15″ from splice.
	.....do													2,235	1 strand 20″ from splice.
8635	1½-inch	1.85	.56	3	7	.....	1.75	82	8	7	3	.....	8.3	3,066	1 strand at the splice.
	.....do													3,212	Do.
	.....do													3,022	Do.
8636	1¾-inch	1.90	.61	3	8	.....	1.75	78	0	8	13	.....	10.8	3,220	1 strand 10″ from splice.
	.....do													3,085	1 strand at the splice.
	.....do													3,056	Do.
8637	1¾-inch	1.93	.62	3	9	.....	1.77	101	4	10	13¾	.....	10.3	3,660	1 strand 12″ from splice.
	.....do													3,210	1 strand 24″ from splice.
	.....do													3,496	1 strand 18″ from splice.
8638	2-inch	2.21	.74	3	11	.....	1.95	88	2	12	4¾	.....	13.4	3,750	1 strand 24″ from splice.
	.....do													3,845	1 strand 18″ from splice.
	.....do													3,730	1 strand 12″ from splice.
8639	2¼-inch	2.43	.79	3	14	.....	2.20	107	5	18	1¼	1.01	.....	6,230	1 strand 10″ from splice.
	..... do													6,180	1 strand at the splice.
	.....do													6,210	Do.
8640	.....do	2.38	.78	4	10	6	2.35	97	1	17	6½	1.08	.....	5,690	Do.
	.....do													5,710	Do.
	.....do													5,370	1 strand 12″ from splice.
8641	2½-inch	2.63	.85	3	17	.....	2.50	115	1	23	14	1.24	.....	7,020	1 strand at the splice.
	.....do													7,010	Do.
	.....do													6,940	Do.
	.....do													6,820	Do.

MANILA ROPE FROM SEWALL & DAY MILLS, BOSTON, MASS.—Continued.

No. of test.	Nominal size of rope.	Actual circumference.	Diameter.	Number of strands.	Threads per strand.	Threads in core.	Lay, one turn in—	Length.	Weight.	Weight per fathom.		Tensile strength.	Parted.
		Inches.	*Inches.*				*Inches.*	*Ft. In.*	*Lbs. Oz.*	*Pounds.*	*Ounces.*	*Pounds.*	
8642	2¾-inch	2.98	.96	3	20	.....	2.60	80 7	19 14½	1.48	.....	9,310	1 strand at the splice.
	do											9,150	Do.
	do											9,020	Do.
8643	3-inch	3.13	1.00	3	24-25-24	.....	2.75	70 11	19 0½	1.61	.....	10,500	Do.
	do											11,080	Do.
	do											10,410	Do.
8644	do	3.02	.99	4	17	6	3.00	69 6	19 7	1.68	.....	10,540	Do.
	do											9,810	Do.
	do											10,430	Do.
8645	3½-inch	3.44	1.13	3	28	.....	2.90	75 3	25 9	2.04	.....	12,160	Do.
	do											12,090	Do.
	do											12,030	Do.
8646	3⅝-inch	3.60	1.19	3	33	.....	3.10	146 1	57 7	2.36	.....	14,200	2 strands at the splice.
	do											12,920	1 strand at the splice.
	do											12,030	Do.
8647	3¾-inch	3.96	1.29	3	38	.....	3.25	85 7	37 14½	2.66	.....	15,820	Do.
	do											14,500	Do.
	do											15,360	Do.
8786	do	3.95	1.28	3	37	.....	3.50	14 7½	6 5½	2.60	.....	14,480	1 strand 6″ from splice.
	do											14,690	1 strand at middle of length.
	do											14,750	1 strand 28″ from splice.
8648	4-inch	4.22	1.39	3	42	.....	3.40	103 0	51 12½	3.02	.....	15,670	1 strand at the splice.
	do											13,840	Do.
	do											14,660	Do.
8787	do	4.08	1.34	3	41	.....	3.75	11 10	5 13½	2.96	.....	16,320	1 strand 4″ from splice.
	do											15,740	1 strand at the splice.
	do											15,990	Do.
8788	4¼-inch	4.30	1.41	3	44	.....	3.65	27 6	14 10½	3.20	.....	14,980	Do.
	do											15,020	1 strand 3″ from splice.
	do											14,830	2 strands at the splice.
8649	4½-inch	4.76	1.59	3	54	.....	3.80	85 2	55 0½	3.88	.....	19,480	1 strand at the splice.
	do											19,300	Do.
	do											19,950	Do.
8789	do	4.95	1.61	3	52	.....	4.00	42 8¾	25 0½	3.51	.....	21,450	Do.
	do											21,720	Do.
	do											19,450	Do.

8790	4½-inch	4.92	1.66	3	57		4.25	31	7	21	8	4.08		21,400 Do
	do													21,350 Do
	do													22,960 Do
8650	5-inch	5.35	1.76	3	66		4.12	107	8	84	3	4.73		23,150 Do
	do													23,290 Do.
	do													23,640 Do.
8791	5½-inch	5.90	1.96	3	76		4.80	22	9	20	5½	5.36		28,800 1 strand 2″ from splice.
	do													27,900 1 strand at the splice.
	do													28,850 Do.
8651	6-inch	6.80	2.25	3	92–94–95		5.15	81	1	99	3	7.34		30,720 Do.
	do													32,500 Do.
	do													31,490 Do.
8792	6½-inch	6.80	2.21	3	100		5.30	20	1½	25	5½	7.54		34,300 Do.
	do													35,600 Do.
	do													36,880 Do.
8792	6½-inch	6.98	2.31	3	106		5.60	10	10	14	9	8.06		35,950 Do.
	do													37,100 Do.
	do													35,120 Do.
8794	7-inch	7.72	2.52	3	122		6.10	49	11	76	4	9.16		47,240 Do.
	do													43,100 Do.
	do													46,600 Do.
8795	7½-inch	8.15	2.64	3	140		6.00	48	7½	84	0	10.44		47,750 1 strand 5″ from splice.
	do													46,500 1 strand 6″ from splice.
	do													41,100 1 strand at the splice.
8796	8-inch	8.80	2.83	3	152		6.70	47	11	90	12	11.36		52,800 Do.
	do													56,100 1 strand 6″ from splice.
	do													53,100 1 strand at the splice.
8797	8½-inch	8.78	2.90	3	157		6.80	45	7	85	12	11.29		54,020 Do.
	do													60,200 Do.
	do													59,900 Do.
8798	9-inch	10.00	3.35	3	193		7.50	38	1½	91	8	14.40		58,400 Do.
	do													65,200 1 strand 6″ from splice.
	do													64,550 1 strand at the splice.
8799	9½-inch	10.24	3.45	3	212		7.40	40	4½	110	4	16.38		78,500 Do.
	do													69,760 Do.
	do													72,900 Do.
8800	10-inch	10.88	3.70	3	242		7.75	5	9	17	2½	17.90		70,100 Do.
	do													73,980 Do.
	do													77,650 Do.

SISAL ROPE FROM SEWALL & DAY MILLS, ALLSTON, MASS.

Chemical composition of ashes from sisal rope.

	Per cent.
Silica	0.25
Oxide of Al	8.00
Calcium oxide	45.80
Magnesium oxide	5.86
Oxides of sodium and potassium	27.79
Carbon dioxide	12.30

No. of test.	Nominal size of rope.	Actual circumference.	Diameter.	No. of strands.	Threads per strand.	Threads in core.	Lay, one turn in—	Length.	Weight.	Weight per fathom.		Tensile strength.	Parted.
		Inches.	*Inches.*				*Inches.*	*Ft. In.*	*Lbs. Oz.*	*Pounds.*	*Ounces.*	*Pounds.*	
8652	6-thread	.84	.27	3	2	.....	.75	83 6	1 6½	.....	1.6	446	1 strand at the splice.
	.....do											472	2 strands at the splice.
	.....do											410	Do.
8653	9-thread	1.00	.33	3	3	.....	.90	64 2	1 11½	.....	2.5	595	1 strand 4″ from splice.
	.....do											542	2 strands at the splice.
	.....do											678	Do.
8654	12-thread	1.38	.39	3	4	.....	1.15	80 10	3 5½	.....	4.0	932	1 strand at the splice.
	.....do											1,002	Do.
	.....do											898	Do.
8655	1¼-inch	1.45	.45	3	5	.....	1.37	76 7	4 11½	.....	5.9	1,355	Do.
	.....do											1,440	Do.
	.....do											1,396	Do.
8656	1½-inch	1.82	.56	3	7	.....	1.65	72 5	6 7½	.....	8.6	2,205	Do.
	.....do											1,980	Do.
	.....do											2,015	Do.
8657	1¾-inch	1.99	.63	3	8	.....	2.00	86 5	8 8¾	.....	9.5	2,344	Do.
	.....do											2,312	1 strand 6″ from splice.
	.....do											2,290	1 strand at the splice.
8658	2-inch	2.26	.70	3	10	.....	2.00	76 11	9 14¾	.....	12.4	2,936	Do.
	.....do											3,060	1 strand 6″ from splice.
	.....do											2,780	1 strand at the splice.
8659	2¼-inch	2.56	.81	3	14	.....	2.20	74 8	13 14	1.11	.....	3,830	Do.
	.....do											4,002	Do.
	.....do											4,066	Do.

8660	2¾-inch	2.98	.95	3	19	.....	2.50	75	3	19	12¾	1.57	.....	5,960 Do.
	..... do													5,660 Do.
	.....do													5,580 Do.
8661	3-inch	3.12	1.01	3	19	.....	2.60	80	1	22	7	1.68	.....	5,920 Do.
	.....do													5,940 2 strands at the splice.
	.....do													5,890 Do.
8662	3¼-inch	3.70	1.22	3	27	.....	3.00	68	11	27	2¼	2.36	.....	8,480 1 strand at the splice.
	.....do													7,950 Do.
	.....do													8,200 Do.

MATERIAL FROM BUREAU OF EQUIPMENT, BOSTON NAVY-YARD.

MANILA ROPE.

No. of test.	Nominal size of rope.	Actual circumference.	Diameter.	No. of strands.	Threads per strand.	Threads in core.	Lay, one turn in—	Length.	Weight.	Weight per fathom.		Tensile strength.	Parted.
		Inches.	*Inches.*				*Inches.*	*Ft. In.*	*Lbs. Oz.*	*Pounds.*	*Ounces.*	*Pounds.*	
8663	2½ inch	2.75	.90	3	15	.....	2.62	.....	.....	.....	.....	7,340	1 strand at middle of length.
	....do											7,410	1 strand 25″ from splice.
	....do											6,730	1 strand 6″ from splice.
8664	2¾ inch	3.00	.98	3	18	.....	2.75	.....	.....	.....	.....	9,920	2 strands 30″ from splice.
	....do											10,050	1 strand 12″ from splice.
	....do											10,040	1 strand 2″ from splice.
8665	3 inch	3.20	1.06	3	21	.....	2.75	.....	.....	.....	.....	11,120	1 strand at the splice.
	....do											11,880	Do.
	....do											12,100	Do.
8666	3½ inch	3.85	1.27	4	20	6	3.56	.....	.....	.....	.....	14,270	1 strand 6″ from splice.
	....do											15,900	1 strand 30″ from splice.
	....do											15,720	2½ strands and core at the splice.
8667	3¾-inch	4.05	1.33	4	23	6	3.75	.....	.....	.....	.....	18,500	2 strands and core at the splice.
	....do											17,130	1 strand 24″ from the splice.
	....do											17,900	1 strand 30″ from the splice.
8668	4-inch	4.15	1.37	4	26	6	3.75	.....	.....	.....	.....	18,420	1 strand at middle of length.
	....do											17,220	1 strand 27″ from splice.
	....do											18,850	1 strand at the splice.
8669	4¼-inch	4.60	1.53	4	29	9	4.12	.....	.....	.....	.....	20,010	2 strands and core 26″ from splice.
	....do											17,990	2 strands and core 24″ from splice.
	....do											20,200	2 strands and core 14″ from splice.
8670	4½-inch	4.75	1.59	4	32	9	4.18	.....	.....	.....	.....	19,150	2 strands and core 18″ from splice.
	....do											24,320	1 strand 12″ from splice.
	....do											20,650	2 strands and core 30″ from splice.
8671	6-inch	6.50	2.16	4	59	15	5.75	.....	.....	.....	.....	40,560	1 strand 12″ from splice.
	....do											32,300	2 strands and core 18″ from splice.
	....do											36,900	1 strand 12″ from splice.

HEMP ROPE.

8672	1½-inch	1.70	.55	3	8		1.62					2,005	1 strand 12″ from splice.
8673	2-inch	2.08	.68	4	11		1.93					3,260	1 strand 24″ from splice.
	do											2,920	1 strand 30″ from splice.
	do											3,250	1 strand 25″ from splice.
8674	2½-inch	3.15	1.03	3	26		2.75					8,120	2½ strands at the splice.
	do											7,140	2 strands at the splice.
8675	3-inch	3.42	1.14	3	30		3.25					8,510	1 strand at the splice.
	do											8,320	Do.
8676	3½-inch	4.33	1.39	3	48		3.95					14,420	Do.
	do											12,950	1 strand 12″ from splice.

HEMP BOLT ROPE.

8677	2-inch	2.08	.68	3	16		1.95					4,210	3 strands at the splice.

RATLINE.

8678	18 thread	1.42	.47	3	6		1.5					2,020	2 strands 18″ from splice.
	do											1,960	1 strand at the splice.

COD LINE.

8679		.65	.20	3	2		.60					648	3 strands 22″ from splice.
												624	3 strands 30″ from splice.
												627	Do.

MANILA ROPE.

SAMPLES FROM COILS IN STORE AT THE WATERTOWN ARSENAL.

No. of test.	Nominal size of rope.	Actual circumference.	Diameter.	No. of strands.	Threads per strand.	Threads in core.	Lay, one turn in—	Length.	Weight.	Weight per fathom.		Tensile strength.	Parted.
		Inches.	*Inches.*				*Inches.*	*Ft. In.*	*Lbs. Oz.*	*Pounds.*	*Ounces.*	*Pounds.*	
8696	1-inch	1.15	.38	3	4		1.00					1,458	1 strand 12" from splice.
8697	1½-inch	1.86	.61	3	8		1.75					3,690	1 strand 36" from splice.
8698	2½-inch	2.52	.83	3	17		2.30					7,530	1 strand at the splice.
8699	2¾-inch	2.90	.94	3	23		2.62					7,990	Do.
8700	3-inch	3.00	.99	3	24		2.62					9,750	Do.
8701	3¼-inch	3.27	1.08	3	27		3.22					11,420	Do.
8702	4-inch	4.30	1.41	3	43		3.55					15,810	Do.
8703	4¼-inch	4.35	1.44	3	44		3.90					16,000	Do.
8704	4½-inch	4.75	1.56	3	52		3.85					19,880	Do.
8705	5-inch	5.35	1.76	3	62		4.50					24,960	Do.
8706	.....do	5.35	1.76	3	62		4.50					22,040	Do.
8707	6-inch	6.80	2.29	3	92		5.35					34,400	Do.

NOTE.—Continuing the stress after the fracture of one strand in test No. 8707, a maximum stress of 19,000 pounds was reached on the remaining two strands when one more strand parted at the splice. The third strand began to draw out of the eye-spliced end, whereupon the test was discontinued.

COTTON ROPE.

No. of test.	Nominal size of rope.	Actual circumference.	Nominal diameter.	Actual diameter.	No. of strands.	Threads per strand.	Lay, one turn in—	Length.	Weight.	Weight per fathom.	Tensile strength.	Parted.
		Inches.	*Inch.*	*Inch.*			*Inches.*	*Ft. In.*	*Lbs. Oz.*	*Pounds. Ounces.*	*Pounds.*	
8801	No. 1	.....	.....	.13	3	13	.38	55 11	0 4½	..... 0.46	143	3 strands 8″ from splice.
											149	3 strands 17½″ from splice.
											136	3 strands 21½″ from splice.
8802	No. 2	.....	.....	.17	3	27	.48	55 6½	6¾	..... .73	239	3 strands 26″ from splice.
											257	3 strands 10″ from splice.
											266	3 strands 26″ from splice.
8803	No. 3	.....	.....	.20	3	33	.58	52 7½	8	..... .91	302	3 strands 27″ from splice.
											300	3 strands 7″ from splice.
											297	3 strands 9″ from splice.
8804	.....	.65	3/16	.20	3	29	.50	55 10	9½	..... .99	302	3 strands at middle of length.
											298	2 strands at the splice.
											251	Do.
8805	.....	.78	7/32	.24	3	47	.58	56 4	12¾	..... 1.35	364	3 strands 8″ from splice.
											367	2 strands at the splice.
											368	3 strands at the splice.
8806	.....	.89	¼	.27	3	39 fine ..... 20 coarser.. 59	.64	55 9	1 1½	..... 1.86	446	2 strands at the splice.
											487	Do.
											492	3 strands 12″ from splice.
8807	.....	1.02	5/16	.33	3	51 fine ..... 28 coarser.. 79	.79	54 9	1 8½	..... 2.68	745	3 strands at the splice.
											774	1 strand 10″ from splice.
											698	2 strands at the splice.
8808	.....	1.20	⅜	.39	3	71 fine ..... 37 coarser.. 108	.90	57 6	2 5½	..... 3.91	882	Do.
											937	1 strand 10″ from splice.
											984	2 strands at the splice.
8809	.....	1.24	⅜	.41	3	67 fine ..... 42 coarser.. 109	.94	57 11	2 8½	..... 3.68	868	Do.
											886	1 strand 11″ from splice.
											990	3 strands 27″ from splice.

COTTON ROPE—Continued.

No. of test.	Nominal size of rope.	Actual circumference.	Nominal diameter.	Actual diameter.	No. of strands.	Threads per strand.	Lay, one turn in—	Length.	Weight.	Weight per fathom.	Tensile strength.	Parted.
		Inches.	*Inch.*	*Inch.*			*Inches.*	*Ft. In.*	*Lbs.*	*Pounds. Ounces.*	*Pounds.*	
8810	.....	1.42	7/16	.47	3	90 fine ..... 59 coarser.. 149	1.10	58 9	3 8½	..... 5.23	1,073 1,076 1,081	1 strand at middle of length. 1 strand 21″ from splice. 3 strands 18″ from splice.
8811	.....	1.62	½	.54	3	165 fine ..... 74 coarser.. 239	1.28	56 3	4 7½	..... 7.65	1,758 1,752 1,584	1 strand at middle of length. 1 strand 18″ from splice. 1 strand at the splice.
8812	.....	2.08	5/8	.67	3	169 fine ..... 137 coarser.. 306	1.55	53 10	6 8½	..... 11.12	2,243 2,490 2,556	2 strands at the splice. 1 strand near middle of length. 2 strands at the splice.
8813	.....	2.48	¾	.79	3	169 fine ..... 188 coarser.. 357	1.80	54 0	8 5	..... 14.78	3,035 3,025 3,062	1 strand at the splice. 2 strands at the splice. 1 strand near middle of length.

MISCELLANEOUS SMALL MATERIAL FROM BUREAU OF EQUIPMENT, BOSTON NAVY-YARD.

[Specimens secured around grooved pins about 4 feet apart.]

No. of test.	Name.	Material.	Diameter.	Description.	Tensile strength.	Parted.
			Inch.		*Pounds.*	
8894	6-thread seizing, American	Tarred hemp	.26	3 strands, 2 threads each	560	2 strands 6½″ from pin.
					573	1 strand 4″ from pin.
8895	9-thread seizing, American	do	.30	3 strands, 3 threads each	712	1 strand 5″ from pin.
					749	1 strand 22″ from pin.
8896	Roundline, American	do	.20	3 threads	322	3 strands 5″ from pin.
					261	1 strand 13″ from pin.
8897	Houseline, American	do	.16	do	279	3 strands 18″ from pin.
					282	1 strand 19″ from pin.
8898	3-yarn spun yarn, Russia	do	.18	do	398	3 yarns 15″ from pin.
					396	3 yarns 18″ from pin.
8899	Signal halliards	Linen, braided	.38	8 strands; 4 strands of 5 threads each, 4 strands of 6-threads each. Threads, 3-ply.	706	Square break 11″ from pin.
					761	Square break at the pin.
8900	Distance line	Linen	.30	Braided line. 8 strands; 7 strands of 3 threads each, 1 strand of 5 threads. Threads, 3-ply.	534	Square break at middle of length.
					504	Square break 23″ from pin.
8901	Hand lead line, $\frac{1}{32}$ diameter	do	.29	Braided line. 18 strands; 11 of 3 threads each, 7 of 2 threads each. Threads, 3-ply.	792	At middle of length.
					881	13″ from the pin.
8902	Boat line, $\frac{4}{32}$ diameter	do	.24	Braided line. 18 strands of 5 threads each	598	18″ from the pin.
					552	12″ from the pin.
8903	Cotton, 42-thread		.29	Twisted line. 3 strands of 14 threads each. Threads, 6-ply. Lay, one turn in 0″.68.	573	Do.
					597	1 strand at the pin.
					794	At the pin.
8904	Cotton, 24-thread		.25	Twisted line. 3 strands of 8 threads each. Threads, 8-ply. Lay, one turn in 0″.61	402	3 strands at the pin.
					412	Do.
8905	No. 0 fishing line	Linen	.14	Twisted line. 3 strands of 3 threads each. Threads, 3-ply. Lay, one turn in 0″.33.	171	1 strand 24″ from pin.
					148	1 strand 7″ from pin.
8906	No. 3 fishing line	do	.07	Twisted line. 3 strands of 1 thread each. Threads, 3-ply. Lay, one turn in 0″.21.	51	2 strands 17″ from pin.
					55	3 strands 15″ from pin.

MISCELLANEOUS SMALL MATERIAL FROM BUREAU OF EQUIPMENT, BOSTON NANY-YARD—Continued.

No. of test.	Name.	Material.	Diameter.	Description.	Tensile strength.	Parted.
			Inch.		*Pounds.*	
8907	Spun yarn	Manila			328	4″ from the pin.
					324	At middle of length.
					297	3″ from the pin.
					338	5″ from the pin.
8908	Bolt-rope yarn	Tarred hemp			134	13″ from the pin.
					124	5″ from the pin.
8909	Shroud yarn	do			97	14″ from the pin.
					95	21″ from the pin.
					98	17″ from the pin.
					122	At the pin.
8910	Spun yarn	American flax			112	19″ from the pin.
					101	9″ from the pin.
8911	do	Russian flax			71	16″ from the pin.
					114	4″ from the pin.
8912	do	Russian untarred bolt-rope yarn.			93	18″ from the pin.
					91	2″ from the pin.
					115	At middle of length.

TABULATION OF MEAN RESULTS.

MANILA ROPE FROM SEWALL & DAY MILLS.

Nominal size of rope.	Actual circumference.	Diameter.	Mean tensile strength.			Remarks.
			Total.	Per yarn.	Per pound weight, per fathom.	
	Inches.	*Inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
6-thread	0.84	0.27	758	126	7,134	
9-thread	1.00	.30	1,064	118	6,548	
12-thread	1.20	.38	1,473	123	6,734	
15-thread	1.42	.43	2,180	145	7,751	
1¼-inch	1.58	.49	2,242	125	6,643	
1½-inch	1.85	.56	3,100	148	5,976	
1⅝-inch	1.90	.61	3,120	130	4,622	
1¾-inch	1.93	.62	3,455	128	5,367	
2-inch	2.21	.74	3,775	114	4,507	
2¼-inch	2.43	.79	6,207	148	6,145	
2½-inch	2.38	.78	5,509	138	5,176	4-strand rope.
2¼-inch	2.68	.85	6,947	136	5,602	
2¾-inch	2.98	.96	9,160	153	6,189	
3-inch	3.13	1.00	10,663	146	6,623	
3-inch	3.02	.99	10,260	151	6,107	4-strand rope.
3¼-inch	3.44	1.13	12,093	144	5,928	
3½-inch	3.60	1.19	13,050	132	5,529	
3¾-inch	3.96	1.29	15,227	134	5,724	
3¾-inch	3.95	1.28	14,640	132	5,631	
4-inch	4.22	1.39	14,723	117	4,875	
4-inch	4.08	1.34	16,017	130	5,411	
4¼-inch	4.30	1.41	14,943	113	4,670	
4½-inch	4.76	1.59	19,577	121	5,046	
4¼-inch	4.95	1.61	20,873	134	5,947	
4¾-inch	4.92	1.66	21,903	128	5,368	
5-inch	5.35	1.76	23,360	118	4,939	
5⅛-inch	5.90	1.96	28,517	125	5,320	
6-inch	6.80	2.25	31,570	112	4,301	
6¼-inch	6.80	2.21	35,593	118	4,721	
6⅜-inch	6.98	2.31	36,057	113	4,474	
7-inch	7.72	2.52	45,647	125	4,983	
7¼-inch	8.15	2.64	45,117	107	4,322	
8-inch	8.80	2.83	54,000	118	4,754	
8⅛-inch	8.78	2.90	58,040	123	5,140	
9-inch	10.00	3.35	62,717	108	4,355	
9⅛-inch	10.24	3.45	73,720	116	4,501	
10-inch	10.88	3.70	73,910	102	4,129	

SISAL ROPE FROM SEWALL & DAY MILLS.

6-thread	.84	.27	432	72	3,240	
9-thread	1.00	.33	605	67	3,872	
12-thread	1.38	.39	944	79	3,776	
1¼-inch	1.45	.45	1,397	93	3,789	
1½-inch	1.82	.56	2,067	99	3,846	
1¾-inch	1.99	.63	2,315	96	3,899	
2-inch	2.26	.70	2,925	97	3,774	
2¼-inch	2.56	.81	3,966	94	3,573	
2¾-inch	2.98	.95	5,733	101	3,652	
3-inch	3.12	1.01	5,917	104	3,522	
3¼-inch	3.70	1.22	8,230	102	3,487	

MANILA ROPE FROM BOSTON NAVY-YARD.

2¼-inch	2.75	.90	7,160	159	.....	
2¾-inch	3.00	.98	10,003	185	.....	
3-inch	3.20	1.06	11,700	186	.....	
3¼-inch	3.85	1.27	15,297	191	.....	4-strand rope.
3¾-inch	4.05	1.33	17,843	194	.....	Do.
4-inch	4.15	1.37	18,163	174	.....	Do.
4¼-inch	4.60	1.53	19,400	167	.....	Do.
4¾-inch	4.75	1.59	21,373	167	.....	Do.
6-inch	6.50	2.16	36,587	155	.....	Do.

HEMP ROPE FROM BOSTON NAVY-YARD.

1¼-inch	1.70	.55	2,005	84	.....	
2-inch	2.08	.68	3,143	71	.....	4-strand rope.
2¾-inch	3.15	1.03	7,630	98	.....	
3-inch	3.42	1.14	8,415	94	.....	
3¾-inch	4.33	1.39	13,685	95	.....	

SHOT LINES.

SHOT LINES TESTED FOR LIFE-SAVING SERVICE.

Lines made of Smith & Dove's best sail twine.
The weights of coils includes sisal straps.
Ends of lines secured by winding around grooved pins. Length of lines between pins about 5 feet.

No. 9 SHOT LINES.

Length of coils, 600 yards.
Diameter of lines, ".29.
Three strands of 16 threads each.
Lay, one turn in 1.04".

No. of test.	Weight of coil.	End of coil tested.	Tensile strength.	Parted.
	Lbs. oz.		*Pounds.*	
8964	35 8	Outside.....	1,191	1 strand 8" from pin.
8965	35 4	Inside.....	1,198	2 strands at middle.
8966	35 12	Outside.....	1,072	1 strand 6" from pin.
8967	35 8	.....do.....	1,351	1 strand at the pin.
8968	35 4	Inside.....	1,222	1 strand 12" from pin.
8969	35 4	.....do.....	1,301	1 strand at the pin.
8970	35	Outside.....	1,239	1 strand 24" from pin.
8971	35 8	.....do.....	1,194	1 strand 15" from pin.
8972	35 4	.....do.....	1,195	1 strand at the pin.
8973	35 4	.....do.....	1,259	2 strands at middle.
8974	35 8	.....do.....	1,266	1 strand 24" from pin.
8975	35 12	.....do.....	1,080	2 strands at the pin.
8976	35 4	.....do.....	1,244	1 strand at the pin.
8977	35 8	.....do.....	1,198	Do.
8978	35 12	.....do.....	1,250	Do.
8979	35 4	.....do.....	1,231	1 strand 12" from pin.
8980	35 12	.....do.....	1,394	1 strand at the pin.
8981	35 8	.....do.....	1,274	Do.
8982	35 8	Inside.....	1,205	Do.
8983	35 8	Outside.....	1,305	2 strands 6" from pin.
8984	35 12	.....do.....	1,298	1 strand 18" from pin.
8985	35 8	.....do.....	1,302	1 strand at the pin.
8986	35 12	.....do.....	1,272	Do.
8987	35 8	.....do.....	1,295	Do.
8988	35 8	.....do.....	1,302	Do.
8989	35	.....do.....	1,180	2 strands 18" from pin.
8990	35 8	.... do.....	1,278	1 strand 25" from pin.
8991	35 12	.....do.....	1,281	1 strand at the pin.
8992	35 12	.....do.....	1,304	2 strands at the pin.
8993	35 8	.....do.....	1,351	1 strand 13" from pin.
8994	35 8	.....do.....	1,272	2 strands at the pin.
8995	35 12	.....do.....	1,294	2 strands 15" from pin.
8996	35 4	.....do.....	1,239	2 strands at the pin.
8997	35 8	Inside.....	1,236	1 strand at the pin.
8998	35 8	Outside.....	1,256	1 strand 6" from pin.
8999	35 12	.....do.....	1,241	1 strand at the pin.
9000	35 4	.....do.....	1,193	Do.
9001	35 4	.....do.....	1,198	1 strand 16" from pin.
9002	35 8	.....do.....	1,250	3 strands at the pin.
9003	35 4	.....do.....	1,175	1 strand 16" from pin.
9004	35 4	.....do.....	1,197	1 strand 8" from pin.
9005	35 8	.....do.....	1,168	1 strand 9" from pin.
9006	35 8	.....do.....	1,258	1 strand at the pin.
9007	35 12	.....do.....	1,255	Do.
9008	35 4	.....do.....	1,200	Do.
9009	35 8	Inside.....	1,374	Do.
9010	35 8	Outside.....	1,159	Do.
9011	35 8	.....do.....	1,247	1 strand 12" from pin.
9012	35 4	.....do.....	1,184	2 strands at the pin.
9013	35 4	.....do.....	1,343	2 strands 14" from pin.

No. 7 Shot Lines.

Length of coils, 650 yards.
Diameter of lines ".23.
Three strands of 9 threads each.
Lay, one turn in ".86.

No. of test.	Weight of coil.		End of coil tested.	Tensile strength.	Parted.
	Lbs.	*Oz.*		*Pounds.*	
9014	21	3½	Outside.....	864	1 strand 18" from pin.
9015	21	5	.....do	882	2 strands 21" from pin.
9016	21	5½	.....do	805	1 strand at the pin.
9017	21	5	.....do	810	1 strand 16" from pin.
9018	21	4½	.....do	832	1 strand at the pin.
9019	21	2½	Inside	808	1 strand 22" from pin.
9020	21	5½	.....do	839	2 strands 10" from pin.
9021	21	3	Outside.....	778	1 strand 24" from pin.
9022	21	3½	.....do	793	2 strands at the middle.
9023	21	3	.....do	796	1 strand 19" from pin.
9024	21	3	.....do	849	2 strands 6" from pin.
9025	21	5	.... do	847	1 strand at the middle.
9026	21	5	.... do	870	2 strands at the pin.
9027	21	4½	.....do	773	1 strand at the middle.
9028	21	5	.....do	819	1 strand at the pin.
9029	21	2½	.....do	799	1 strand 12" from pin.
9030	21	5½	Inside	851	1 strand at the pin.
9031	21	3½	Outside.....	828	1 strand 10" from pin.
9032	21	1½	Inside	801	1 strand at the middle.
9033	21	2½	Outside.....	756	1 strand 15" from pin.
9034	21	4	.....do	798	1 strand at the pin.
9035	21	5½	.....do	812	Do.
9036	21	1½	.....do	840	1 strand 6" from pin.
9037	21	5½	.....do	833	1 strand at the pin.
9038	21	5	.....do	703	1 strand 19" from pin.
9039	21	1½	.....do	797	1 strand at the pin.
9040	21	2½	.....do	792	Do.
9041	21	4	.....do	851	Do.
9042	21	4	Inside	839	1 strand 26" from pin.
9043	21	2	Outside.....	797	1 strand 16" from pin.
9044	21	3	Inside	821	1 strand 27" from pin.
9045	21	4	Outside.....	763	2 strands 24" from pin.
9046	21	3½	.....do	797	1 strand 27" from pin.
9047	21	4	.....do	837	1 strand 12" from pin.
9048	21	4	.....do	772	1 strand 21" from pin.
9049	21	4½	.....do	864	1 strand 18 from pin.
9050	21	5½	.....do	849	1 strand 3" from pin.
9051	21	6	.....do	842	1 strand at the pin.
9052	21	5½	.....do	892	Do.
9053	21	2½	.....do	803	1 strand 9" from pin.
9054	21	3½	.....do	795	1 strand at the pin.
9055	21	4	Inside	801	Do.
9056	21	4	Outside.....	804	Do.
9057	21	4	.....do	848	1 strand 18" from pin.
9058	21	4½	.....do	839	2 strands 14" from pin.
9059	21	3½	.....do	834	1 strand at the pin.
9060	21	4½	.....do	884	Do.
9061	21	1½	Inside	790	1 strand 14" from pin.
9062	21	2½	.....do	779	1 strand at the pin.
9063	21	4	Outside.....	695	1 strand at the middle.
9063*a*			.....do	779	2 strands 9" from the pin.

No. 4 Shot Lines.

Length of coils, 700 yards.
Diameter of lines, ".14.
Three strands of 4 threads each.
Lay, one turn in ".64.

No. of test.	Weight of coil.		End of coil tested.	Tensile strength.	Parted.
	Lbs.	*Oz.*		*Pounds.*	
9064	10	7½	Outside	368	2 strands 6" from pin.
9065	10	6½	do	371	1 strand 14" from pin.
9066	10	6½	do	371	1 strand 18" from pin.
9067	10	7	do	393	1 strand 8" from pin.
9068	10	6½	do	355	1 strand 19" from pin.
9069	10	6	Inside	374	1 strand 18" from pin.
9070	10	7	Outside	383	1 strand at the middle.
9071	10	7½	Inside	401	3 strands at the pin.
9072	10	7	Outside	370	1 strand 21" from pin.
9073	10	8	do	418	2 strands 2" from pin.
9074	10	7½	do	346	1 strand at the middle.
9075	10	7	do	370	1 strand 13" from pin.
9076	10	4	do	398	3 strands 27" from pin.
9077	10	6	do	368	1 strand 18" from pin.
9078	10	6	do	394	3 strands 24" from pin.
9079	10	3	do	377	3 strands at middle.
9080	10	8	Inside	392	1 strand 18" from pin.
9081	10	7½	Outside	390	2 strands at the pin.
9082	10	7	do	396	1 strand 18" from the pin.
9083	10	7	Inside	402	1 strand 12" from pin.
9084	10	8	Outside	395	1 strand 8" from pin.
9085	10	7½	do	364	1 strand 13" from pin.
9086	10	7½	do	348	1 strand at the pin.
9087	10	7½	do	378	1 strand 15" from pin.
9088	10	6	do	388	1 strand at the middle.
9089	10	7	Inside	399	3 strands 6" from pin.
9090	10	5½	Outside	361	1 strand at the middle.
9091	10	5	do	359	3 strands at the pin.
9092	10	6	do	381	1 strand 16" from pin.
9093	10	3½	Inside	394	3 strands 4" from pin.
9094	10	7½	Outside	392	2 strands 16" from pin.
9095	10	3½	Inside	351	1 strand at the middle.
9096	10	6½	Outside	383	2 strands at the middle.
9097	10	7	do	374	1 strand 14" from pin.
9098	10	3½	Inside	395	1 strand at the pin.
9099	10	2	Outside	392	3 strands at the pin.
9100	10	3½	do	398	2 strands 19" from pin.
9101	10	4½	do	384	2 strands at the middle.
9102	10	2	do	371	3 strands at the middle.
9103	10	4½	do	402	2 strands 5" from pin.
9104	10	3	do	376	1 strand 12" from pin.
9105	10	7½	do	386	1 strand at the middle
9106	10	6	do	401	1 strand 12" from pin.
9107	10	3½	Inside	406	3 strands 12" from pin.
9108	10	4½	Outside	392	3 strands 2" from pin.
9109	10	4	do	399	1 strand 19" from pin.
9110	10	4	do	396	3 strands 24" from pin.
9111	10	8	do	354	1 strand at the middle.
9112	10	7½	do	378	2 strands 2" from the pin.
9113	10	7½	do	405	2 strands at the middle.

No. 8961.

TENSILE TEST OF GALVANIZED STEEL WIRE ROPE.

Rope composed of 6 strands, of 19 wires each and jute core.
Diameter of rope, ".71.
Diameter of wires about ".047 each.
Tensile strength, 12,190 pounds.
Parted one strand 4" from face of jaws.

CHEMICAL ANALYSES OF STEELS.

CHEMICAL ANALYSES.

STEELS FROM SPRINGFIELD ARMORY.

Tension test No.	Description.	Marks.	Carbon.	Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.	Nickel.	Remarks.
5537	Stock for barrels	49	0.460	1.377	0.186	0.100	0.095	0.142	.....	
5538	From forged barrel	49A	0.500	1.220	0.173	0.102	0.060	0.138	.....	
5539	Bar 1".05 diameter	60	0.555	1.313	0.148	0.120	0.060	0.098	.....	
5540	New stock	61	0.530	1.274	0.360	0.055	0.046	0.142	.....	
5542	Bar 1¼" diameter	62	0.422	1.900	0.435	0.065	0.080	0.090	.....	Steel for rifle barrels.
5543	Bar 1".15 diameter	63	0.534	1.421	0.417	0.115	0.045	0.100	.....	
5544	.....do	64	0.541	1.614	0.418	0.075	0.080	0.083	.....	
5545	Receivers of rifles	32 R	0.350	0.787	0.176	0.055	0.068	0.052	.....	
	New barrel, not chambered, same stock as eroded barrels.	.....	0.515	1.200	0.061	0.082	0.075	.....	.....	
5562	Rifle barrel steel	61 S	0.534	0.988	0.601	0.059	0.047	0.083	.....	
5575	.....do	65	0.360	0.700	0.275	0.026	0.080	0.168	3.980	
5576	.....do	66	0.622	0.564	0.105	0.048	0.107	0.079	0.073	
5578	.....do	67	0.515	1.124	0.118	0.055	0.081	0.127	0.092	
5580	Rolled rifle barrel	49	0.520	1.058	0.177	0.096	0.068	0.199	0.154	Regular stock in use.
5604	Rifle barrel steel	68-1	0.475	1.530	0.169	0.088	0.076	0.271	0.267	
5607	.....do	68-4	0.480	1.662	0.122	0.107	0.055	0.250	0.259	
5613	.....do	68-5	0.539	1.404	0.116	0.100	0.076	0.210	.....	
5615	.....do	68-2C	0.530	1.441	0.150	0.072	0.064	0.245	.....	Rolled barrel, annealed in charcoal.
5644	.....do	5A	0.585	1.420	0.150	0.107	0.070	0.138	0.075	Rolled barrel, annealed in air.
5644	.....do	5A	0.609	1.456	0.142	0.091	0.077	0.142	0.090	Do.
5651	.....do	X.1	0.540	1.213	0.169	0.080	0.051	0.191	0.361	Steel as received, first heat.
5652	.....do	X.2	0.590	1.400	0.159	0.074	0.060	0.183	0.125	Steel as received, second heat.
5657	.....do	X.3	0.545	1.581	0.178	0.077	0.045	0.095	0.115	Steel as received, third heat.
5663	.....do	72	0.506	1.777	0.182	0.074	0.045	0.279	0.256	From bar as received.
5664	.....do	72 A	0.495	1.762	0.188	0.077	0.045	0.285	0.250	Rolled barrel, annealed.
5665	.....do	72 C	0.509	1.788	0.180	0.075	0.047	0.287	0.255	Rolled barrel, annealed in charcoal.
5672	.....do	70 X	0.564	1.592	0.225	0.080	0.055	0.167	0.314	
5697	Steel for Gatling-gun barrels	C_3	0.570	0.800	0.256	0.045	0.071	0.103	.....	
5706	.....do	C_4	0.292	0.650	0.178	0.035	0.030	0.126	5.029	
5719	Rifle-barrel steel	75	0.500	1.500	0.188	0.045	0.067	0.152	.....	

CHEMICAL ANALYSES—Continued.

MISCELLANEOUS STEELS.

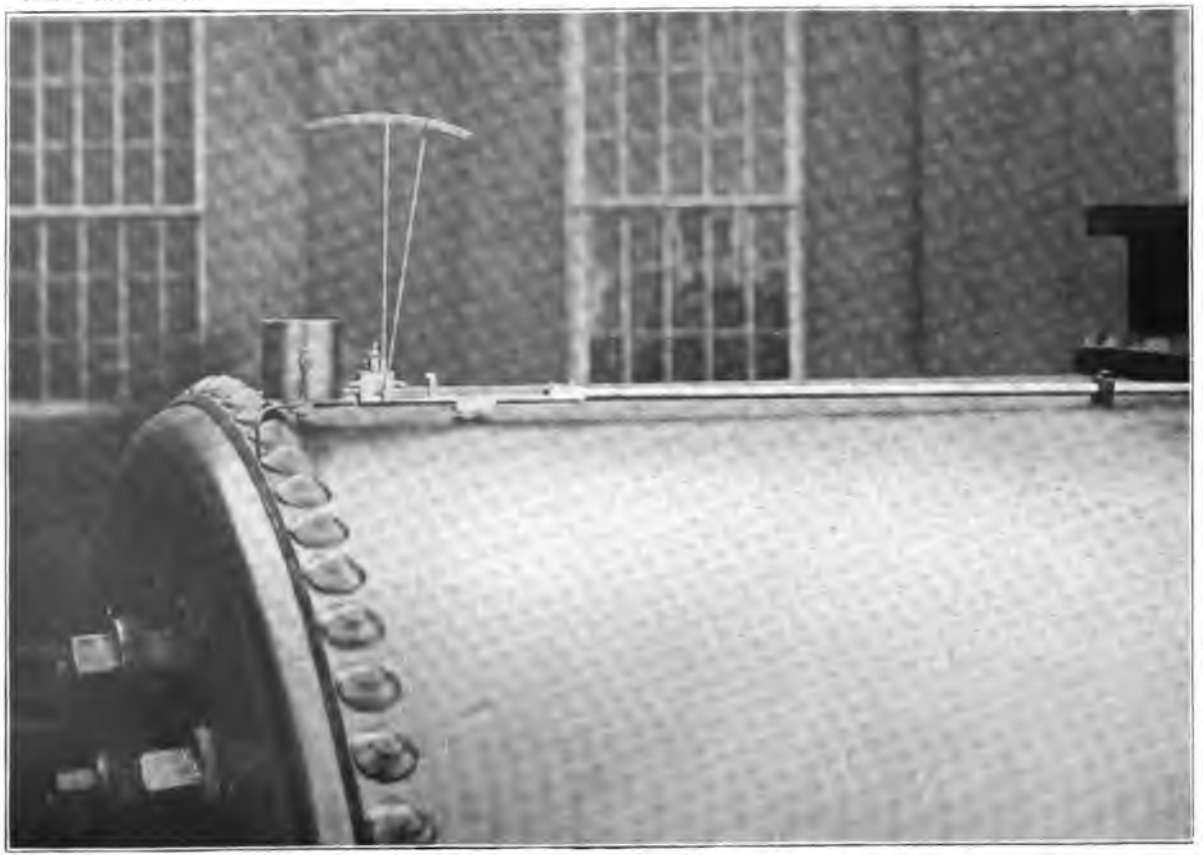
Tension test No.	Description.	Marks.	Carbon.	Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.	Nickel.	Remarks.
5668	Jacket 3".2 B. L. steel field gun	32 R 179 JM T_3 J	0.554	0.977	0.225	0.026	0.030	.....	.....	
5606	Tube 3".2 B. L. steel field gun	32 R 176 TB T_2 M	0.554	0.800	0.213	0.028	0.032	.....	.....	
5717	Tube 7" B. L. siege howitzer	8909 B_2 MT_2 M	0.527	0.809	0.205	0.045	0.024	.....	.....	
5549	Jacket 10" steel B. L. rifle	7662 B_2 MT_2 M	0.364	0.882	0.170	0.034	0.031	0.045	.....	
5617	.....do	7866 B_1 BT_2 M	0.460	0.761	0.197	0.027	0.025	0.045	.....	
5674	Jacket 12" steel B. L. rifle	12 R 18 JM T_1 O	0.564	0.645	0.254	0.029	0.030	.....	.....	
5718	Jacket 12" B. L. rifled mortar	8526 B_7 BT_{10} M	0.477	0.775	0.208	0.020	0.023	.....	.....	
	Piston-rod 12" mortar carriage	12 C 30 PRL_1 M	0.545	1.249	0.070	0.035	0.056	0.040	.....	
	.....do	12 C 70 PRL_1 M	0.539	0.880	0.021	0.087	0.042	0.035	.....	
	3".2 shrapnel case	.....	0.718	0.761	0.050	.....	.....	.....	.....	
	.....do	.....	0.116	0.400	0.005	0.056	0.118	.....	.....	
9240	Music wire, No. 14 gauge	.....	0.800	0.199	0.010	0.020	0.020	.....	.....	
9242	Music wire, No. 16 gauge	.....	0.750	0.170	0.009	0.028	0.021	.....	.....	
	Plate for Watertown Arsenal boilers	.....	0.175	0.464	0.014	0.032	0.015	0.035	.....	

STEAM BOILER EXPERIMENTS.

STEAM BOILER EXPERIMENTS.
GENERAL VIEW OF BOILER.

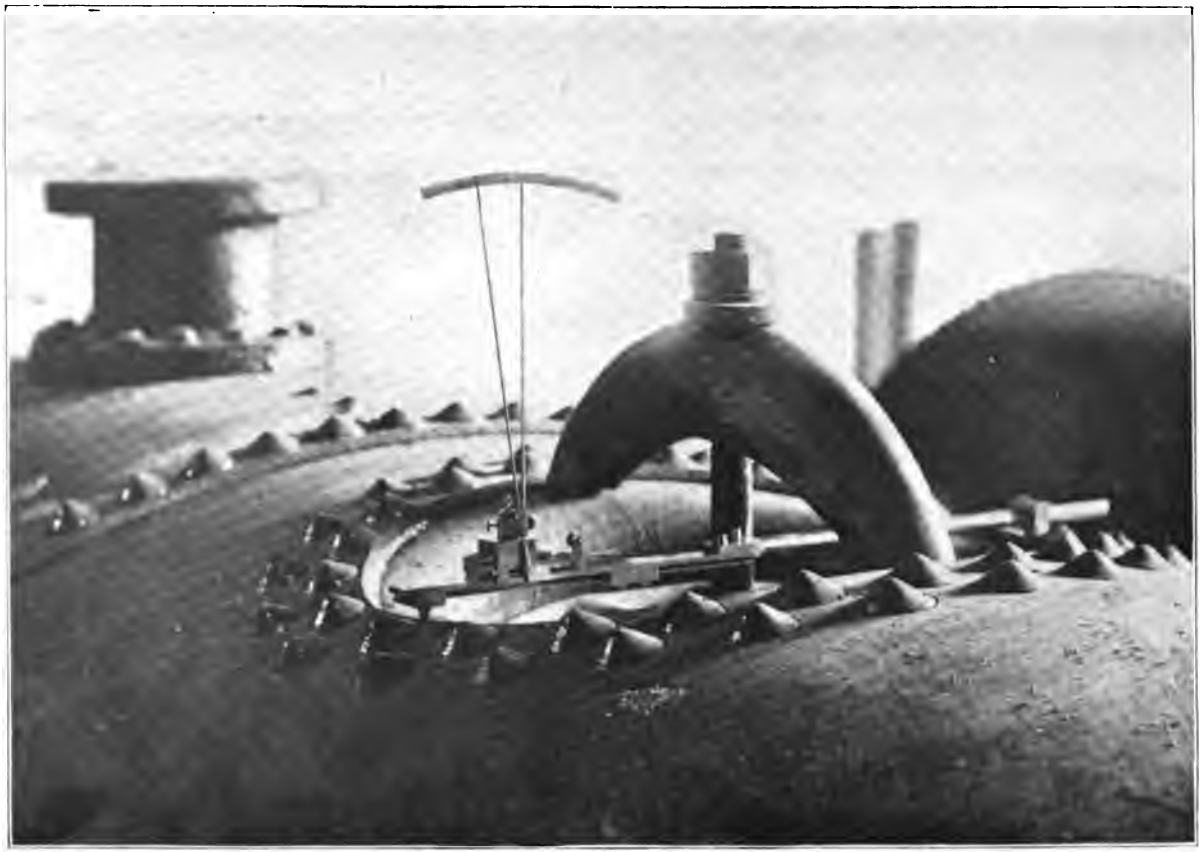
STEAM BOILER EXPERIMENTS.

MICROMETER IN POSITION FOR DETERMINING TANGENTIAL EXTENSION OF SHELL OVER THE SEAM.



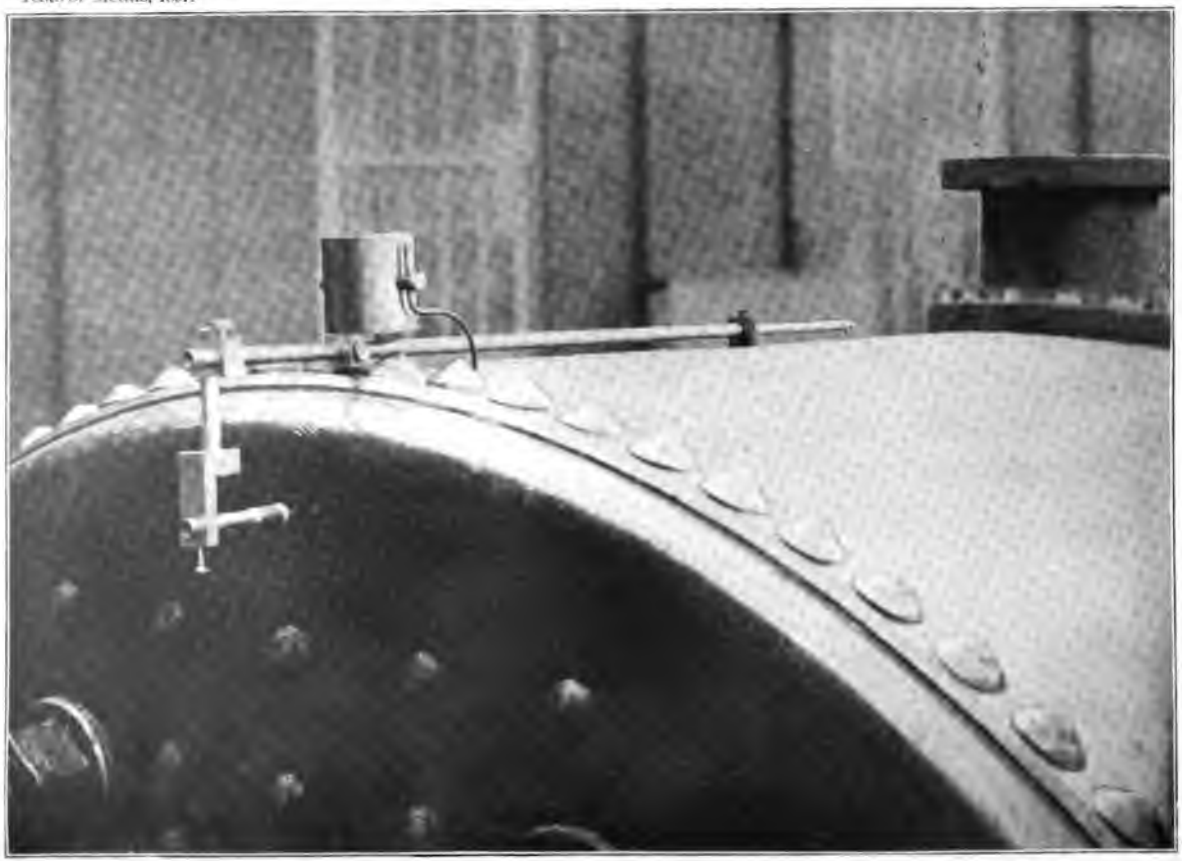
STEAM BOILER EXPERIMENTS.

MICROMETER IN POSITION FOR DETERMINING LONGITUDINAL CONTRACTION OF SHELL.



STEAM BOILER EXPERIMENTS.

MICROMETER IN POSITION FOR DETERMINING EXPANSION IN DIAMETER OF MANHOLE.



STEAM BOILER EXPERIMENTS.

METHOD OF MEASURING BULGING OF HEADS.

STEAM BOILER EXPERIMENTS.

THE MEASUREMENT OF STRAINS DEVELOPED BY HYDROSTATIC PRESSURE.

Experiments were made upon boilers described as follows:

There were three horizontal tubular boilers 72 inches diameter and 17 feet 4 inches long each, built for the arsenal plant.

The shell plates were $\frac{7}{8}$" thick, the heads $\frac{1}{2}$" thick, all of open-hearth steel. The longitudinal seams were triple riveted butt joints with double-covering straps having drilled holes $\frac{7}{8}$" diameter, and machine-driven rivets.

The heads were stiffened by channel bars and braced by means of 5 bolts $1\frac{3}{4}$" diameter each, extending from head to head, and there were 138 3-inch tubes 16 feet long. The manholes had pressed steel frames. The nozzles were 6" diameter and made of cast iron.

The tests were carried out at the shops of the Cunningham Iron Company, Boston, Mass., where the boilers were made, and consisted of measuring the strains in different parts of the boilers when cold-water pressures were applied.

The accompanying photographs show a general view of one of the boilers and the manner of applying the measuring instruments to different parts of the boilers during the tests.

The hydrostatic pressure applied in each experiment was 200 pounds per square inch.

The observations made on the first boiler consisted of measurements on gauged lengths of 5" each, taken tangentially on the longitudinal seams of the front and the middle sheets and longitudinal measurements over the circular seams. In the tangential measurements one end of the micrometer made contact with the outside butt strap and the other with the sheet at points midway the outside row of rivets of the inside butt strap. The gauged lengths over the circular seams reached from sheet to sheet.

The tangential extensions, due to 200 pounds hydrostatic pressure, were ".0016, ".0016, ".0017, and ".0017 at four places of observation on the front shell sheet, and ".0019, ".0012, and ".0015 on the middle sheet.

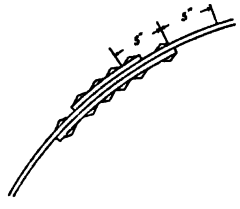
In three places the measurements over the circular seams showed longitudinal extensions of ".0008, ".0005, and ".0008, while at a fourth place there was ".0003 longitudinal contraction.

A gauged length of 182".80 was established along an upper element of the boiler, the extremities of which were about 3" inside the circular lines of riveting at the heads.

Under pressure a longitudinal contraction of ".0049 occurred on this gauged length.

On the second boiler the first measurement showed the tangential extension at the seam in the middle sheet at a place about one-third the length of the sheet from its front edge.

Measuring on 5" length from the outside butt strap to the sheet, the extension here was ".0012.



A corresponding measurement on the front sheet over the seam at the middle of its length showed an elongation of ".0020 in 5", whereas on the solid sheet just above this place the elongation was ".0029.

The next measurements were taken across the larger diameter of the manhole, at right angle to the axis of the boiler.

The gauged length 21".25 was taken on the front side of the center line, to allow the micrometer to clear the bolt in the cover, from reference points on the shell sheet as shown by the photograph. Two hundred pounds pressure caused an elongation on this gauged length of ".0164.

Measurements taken on the smaller diameter, parallel to the axis of the boiler on a gauged length of 18".12, showed an elongation of ".0005.

The metal in the sheet was examined in this vicinity on gauged lengths of 10" each parallel to the larger diameter of the manhole.

On the first gauged length, $3\frac{3}{4}$" from the edge of the hole in the shell sheet, the tangential extension was ".0060, and on succeeding gauged lengths, 6" apart, the extensions were ".0046, ".0049, and ".0049, respectively. On the other side, between the manhole and the circular seam, and $3\frac{1}{2}$" from the edge of the hole, the tangential extension of the sheet was ".0051.

Corresponding measurements in front of the nozzle on the rear sheet showed a tangential extension of ".0058.

The behavior of another boiler, not one of the arsenal three, which was being built in the same shops, was examined at the manhole.

This also was a 72-inch boiler, $\frac{7}{16}$"-shell sheets, but it had a cast steel manhole frame, the weight of which was 157 pounds. On a gauged length of 21".25, as before, the elongation was ".0146.

Resuming the tests on the second arsenal boiler, the extensions of the tubes under pressure were observed. The left center tube in the sixth row from the bottom, and the left tube next the shell in the upper row elongated in their total lengths ".0165 and ".0140, repectively.

The longitudinal contraction of this boiler, gauged length 182".80, along an upper element, was found to be ".0154, and on a ganged length of same dimension, taken on the shell opposite the third row of tubes from the top, the contraction was ".0135.

Observations on the third boiler began with measurements over the longitudinal seam in the middle sheet.

The gauged length was increased to 16", both extremities being on the sheet, thereby including the full width of joint. A photograph shows the micrometer in position over this seam.

The first gauged length was located at a distance of $18\frac{3}{4}$" from the front sheet, where the tangential extension of the joint was found to be ".0067. On a second gauged length, located at a distance of 13".56 from the edge of the rear sheet, the extension was ".0050.

Locating the micrometer over the solid plate at the middle of the width of the rear sheet opposite the seam in the middle sheet, the tangential extension here found was ".0081.

The same observation, made at a corresponding place on the front sheet, showed ".0085 extension of the solid metal.

The rigidity of the joints were thus found greater than the solid plate over the range in stress, due to an interior pressure of 200 pounds per square inch.

The expansion in diameter of the front head, from flange to flange, was next measured.

The vertical diameter expanded ".0119, the horizontal diameter ".0145. The longitudinal contraction of this boiler, on a gauged length

of 182″.80, was found to be ″.0191, taken along a line which came over the longitudinal seam of the middle sheet.

Measuring the longitudinal contraction of each sheet separately, the front sheet, on a gauged length of 45″.80, contracted ″.0059, the rear sheet, on a gauged length of 61″.40, contracted ″.0059, and the middle sheet, over the seam on a gauged length of 75″.60, contracted ″.0075.

In the last measurement the extremities of the gauged length were on the edges of the front and rear sheets, respectively. The three gauged lengths covered the same element on the boiler as the continuous one of 182″.80.

The elongations of five tubes were measured. The right center tube, in the sixth row from the bottom, elongated ″.0154, the outside right-hand tube in the top row ″.0070, the second tube from the right-hand end in the third row from the top ″.0166, the outside left-hand tube in the top row ″.0154, and the outside left-hand tube in the bottom row ″.0140.

The bulging of the heads in the vicinity of the flanges completed the observations.

The bulging at a point on the rear head, 3″ diametrically within the outer circumference of the shell sheet and on the same element as the longitudinal seam of the middle sheet, was referred to a point on the rear edge of the rear sheet. The head at this point bulged ″.0084.

The front head was measured between data points, one 3″ diametrically within the inner side of the flange, and the other on the shell on the outside of the sheet close to the inner side of a rivet head in the circular line of riveting, these points being in line with the upper edge of the inside butt strap of the middle sheet. The bulging here was ″.0266.

The flange of the rear head in the construction of the boiler is turned inward, that of the front head is turned outward.

The photograph shows the means employed for measuring the bulging of the rear head, but not in the location on the boiler where the measurements were taken.

PRIVATE TESTS.

TESTS MADE FOR PRIVATE PARTIES DURING THE FISCAL YEAR ENDED JUNE 30, 1897.

Date.	Material.	For whom tested.		
		Name.	City.	State.
1896.				
July...	Concrete	Woodbury & Leighton	Boston	Mass.
	Metal standards	Library Bureau	do	Mass.
	Greenwich stone	William T. Ritch	New York	N. Y.
	Copperplate	Hartford Steam Boiler Inspection and Insurance Co.	Hartford	Conn.
	Granite	City of Cincinnati	Cincinnati	Ohio.
	Steel tubing	Kellogg Weldless Tube Co	Findlay	Ohio.
	Brass	Bath Iron Works	Bath	Me.
	Malleable iron	Rhode Island Malleable Iron Co	Hills Grove	R. I.
	Cast iron and bronze.	Saladé & Fuller	Catasauqua	Pa.
	Bronze and yellow metal.	Bath Iron Works	Bath	Me.
	Paving bricks	Oliphant & Pope Co	Trenton	N. J.
Aug...	Bookcase standards.	Library Bureau	Boston	Mass.
	Copper cylinders	United States Smokeless Powder Co	San Francisco	Cal.
	Cast iron	Builders Iron Foundry	Providence	R. I.
	Wrought-iron bar	Saladé & Fuller	Catasauqua	Pa.
	Steel bars	The Bethlehem Iron Co	South Bethlehem	Pa.
	Bicycle crank shaft brackets.	The Premier Cycle Manufacturing Co.	Bridgeport	Conn.
	Malleable iron	Rhode Island Malleable Iron Co	Hills Grove	R. I.
	Steel plate	Cunningham Iron Co	South Boston	Mass.
	Tubing	Warwick Tube Co	Newark	N. J.
	Bronze	Bath Iron Works	Bath	Me.
Sept...	do	do	do	Me.
	Steel gear tooth	Kinsley Iron and Machine Co	Canton	Mass.
	Steel plate	E. D. Leavitt	Cambridgeport	Mass.
	Threaded bolts	Houghton & Richards	Boston	Mass.
	Steel bars	The Marlin Fire Arms Co	New Haven	Conn.
	Cast iron	Builders Iron Foundry	Providence	R. I.
	do	The De La Vergne Refrigerating Machine Co.	New York	N. Y.
	Manganese bronze and cast iron.	Hyde Manganese Bronze Co	Bath	Me.
	Tubing	Warwick Tube Co	Newark	N. J.
	Cast iron	Builders' Iron Foundry	Providence	R. I.
	Concrete	Woodbury & Leighton	Boston	Mass.
	Bronze	Bath Iron Works	Bath	Me.
	Cast iron	C. L. Peirson	Boston	Mass.
Oct....	do	Bath Iron Works	Bath	Me.
	Bronze	do	do	Me.
	Concrete	Norcross Brothers	Worcester	Mass.
	Steel bars	P. H. Dudley	New York	N. Y.
Nov...	Cast iron	The De La Vergne Refrigerating Machine Co.	do	N. Y.
	do	Builders' Iron Foundry	Providence	R. I.
	Bronze	Bath Iron Works	Bath	Me.
	Parsons manganese bronze.	The William Cramp & Sons Ship and Engine Building Co.	Philadelphia	Pa.
	Cast iron	J. H. Bickford	Salem	Mass.
	Steel tubing	The Pope Tube Co	Hartford	Conn.
	Bicycle tires	Consolidated Rubber Works	Boston	Mass.
	Bronze	Torrey Roller Bushing Works	Bath	Me.
	Tubing	Benedict & Burnham Manufacturing Co.	Boston	Mass.
	Bicycle spokes	John Wales Co	do	Mass.
	Bronze	Bath Iron Works	Bath	Me.
	Sheet steel	Great Northern Rwy	St. Paul	Minn.
	Stone	Jacob Voorhis	New York	N. Y.
	Concrete columns.	John Lally	Waltham	Mass.
Dec....	Brass	Bath Iron Works	Bath	Me.
	Hooks and shackles.	Boston & Lockport Block Co	Boston	Mass.
	Copperplates and aluminium.	W. C. Temple	do	Mass.
	Cast iron	Builders Iron Foundry	Providence	R. I.
	Steel bar	The Marlin Fire Arms Co	New Haven	Conn.
	Wooden bushing	Dodge Manufacturing Co	Boston	Mass.
	Granite	Rocklin Granite Co	Rocklin	Cal.
	Manganese bronze	Bath Iron Works	Bath	Me.

PRIVATE TESTS—Continued.

Date.	Material.	For whom tested.		
		Name.	City.	State.
1896.				
Dec....	Cast iron	Builders' Iron Foundry	Providence	R. I.
	.....do	The De La Vergne Refrigerating Machine Co.	New York	N. Y.
	Bicycle spokes	John Wales Co	Boston	Mass.
	Column	City of New York	New York	N. Y.
1897.				
Jan....	Cast iron	Builders' Iron Foundry	Providence	R. I.
	Wire rope	New England Mutual Life Insurance Co.	Boston	Mass.
	Hooks	Boston & Lockport Block Co	.....do	Mass.
	Wooden bushings	Dodge Manufacturing Co	.....do	Mass.
	Cast iron	Builders' Iron Foundry	Providence	R. I.
	Wrought-iron studs.	Dodge Manufacturing Co	Boston	Mass.
	Manila rope	Hinckley Bros. & Co	.....do	Mass.
	Sandstone	State of New York	Albany	N. Y.
	Electric cables	F. M. Ferrin	Boston	Mass.
	Hemp rope	J. Baker & Co	.....do	Mass.
	Granite and trap rock.	Otis & Sprague Land Co	Watertown	Mass.
Feb....	Rubber belting	J. H. Lane & Co	Boston	Mass.
	Cast iron	Golding & Co	.....do	Mass.
	Steel bar	The Marlin Fire Arms Co	New Haven	Conn.
	Sandstone	Albee Sandstone Quarries	Fort Dodge	Iowa.
	Brake beam	A. H. Marden	Boston	Mass.
	Riveted chain	Wm. H. Haskell & Co	Pawtucket	R. I.
	Sandstone	The Pennsylvania State College	State College	Pa.
	Rubber belting	Revere Rubber Co	Boston	Mass.
	Cast iron	Bath Iron Works	Bath	Me.
Mar....	Wrought-iron bar and threaded bolts.	Houghton & Richards	Boston	Mass.
	Bronze	Bath Iron Works	Bath	Me.
	Nails	C. C. Loring	Boston	Mass.
	Hydraulic gauge	The Ashton Valve Co	.....do	Mass.
	Manhole and catch basin covers.	City of Boston	.....do	Mass.
Apr....	Bicycle tires	L. C. Chase & Co	Reading	Mass.
	Bronze	Bath Iron Works	Bath	Me.
	Brass	Whittier Machine Co	Boston	Mass.
	Steel bar	The Marlin Fire Arms Co	New Haven	Conn.
	Wire	J. B. Wise	Watertown	N. Y.
	Steel strap	E. D. Leavitt	Cambridgeport	Mass.
	Nails	C. C. Loring	Boston	Mass.
	Plate steel	E. C. Atkins & Co	Indianapolis	Ind.
	Steel plate	The Taunton Locomotive Manufacturing Co.	Taunton	Mass.
	Bicycle tires	L. C. Chase & Co	Reading	Mass.
	Cotton duck	J. H. Lane & Co	Boston	Mass.
	Bricks	Greiner & Corning	St. Paul	Minn.
	Belting	B. F. Goodrich Co	Akron	Ohio.
	Steel plate	H. S. Robinson	Boston	Mass.
	Bronze	The Ashcroft Manufacturing Co	Bridgeport	Conn.
	Cement	Newton & Watertown Gas Light Co.	Newton	Mass.
May....	Copper cylinders	Union Metallic Cartridge Co	Bridgeport	Conn.
	Bicycle material	Tonk Manufacturing Co	Chicago	Ill.
	Belting	J. H. Lane & Co	Boston	Mass.
	Lead pipe	Isaac N. Tucker	.....do	Mass.
	Helical springs	McKay-Bigelow Heeling Machine Association.	Winchester	Mass.
	Cement and bricks	Newton & Watertown Gas Light Co.	Newton	Mass.
	Steel plate	Cunningham & Co	South Boston	Mass.
	Brazed joints	J. L. Marmond	Malden	Mass.
June....	Bronze	The Ashcroft Manufacturing Co	Bridgeport	Conn.
	Tubing	I. L. G. Rice	Auburndale	Mass.
	Copper cylinders	Laflin & Rand Powder Co	New York	N. Y.
	Rubber belting	J. H. Lane & Co	Boston	Mass.
	Bronze	Thomas Laughlin Co	Portland	Me.
	Steel plate	The Bethlehem Iron Co	South Bethlehem	Pa.
	Tie rods	West End Street Railway Co	Boston	Mass.
	Brazed saw blade	E. C. Atkins & Co	Indianapolis	Ind.
	Sandstone	Victor Sandstone Co	Chitwood	Oreg.
	Concrete columns	John Lally	Waltham	Mass.
	Cast iron	The Davis & Johnson Co	Chicago	Ill.
	Stay bolt	Mexican Central Railway Co	Boston	Mass.

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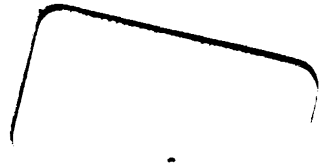
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